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FIG.1

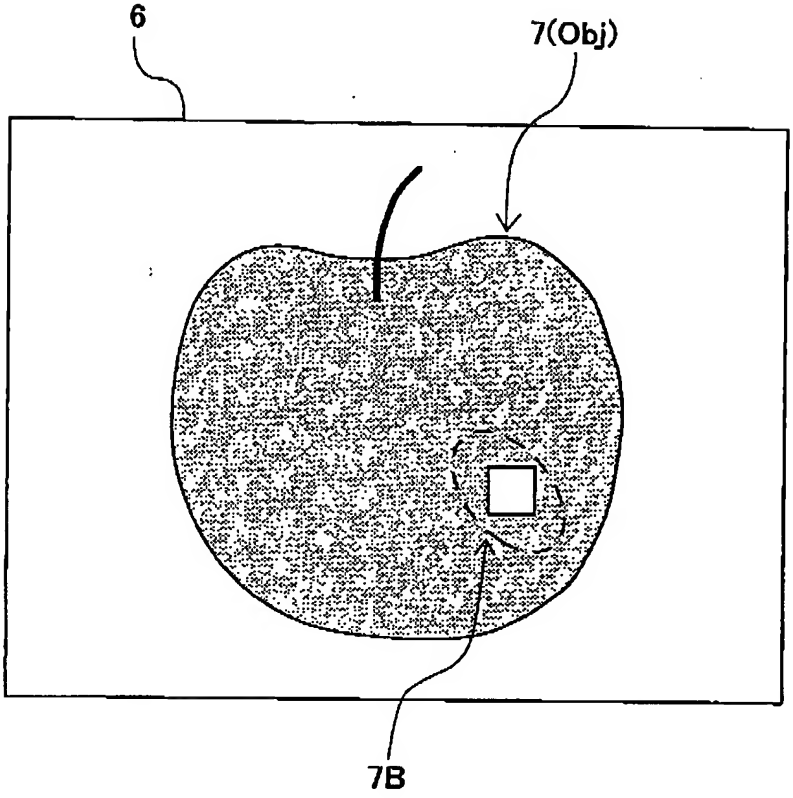

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FIG.2

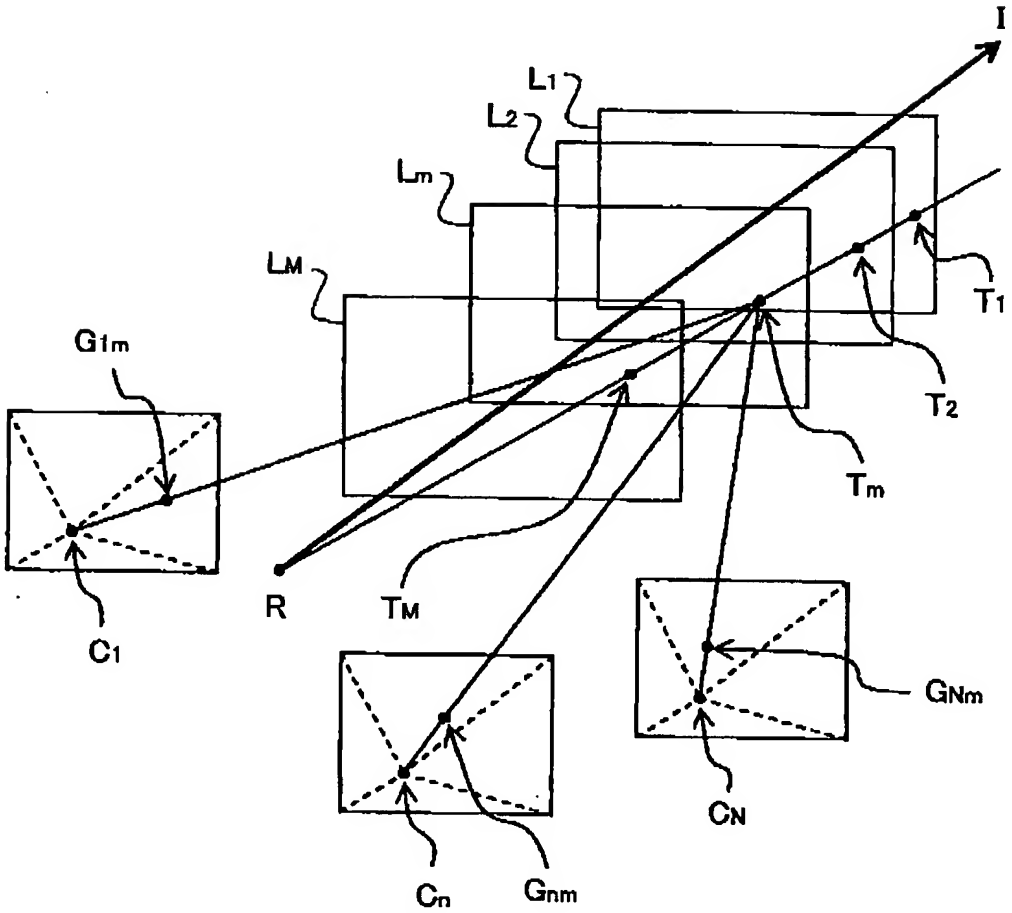

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FIG.3A

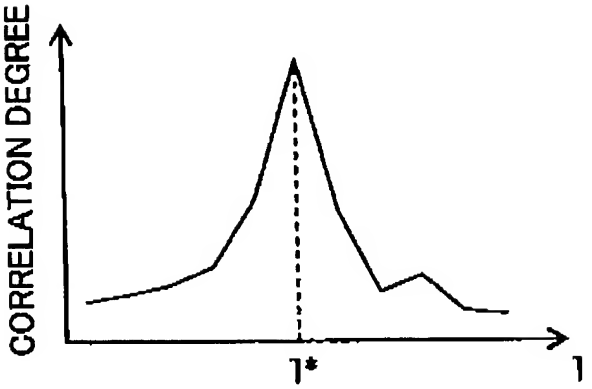

FIG.3B

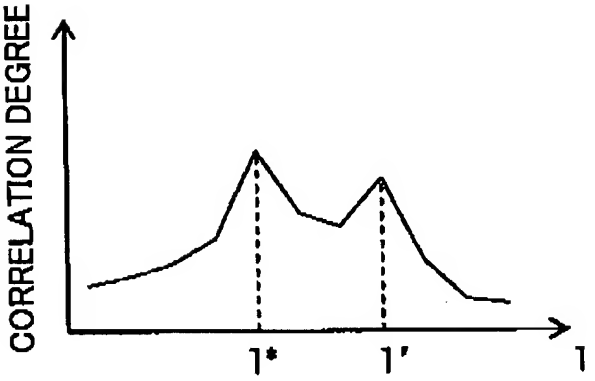

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FIG.4A

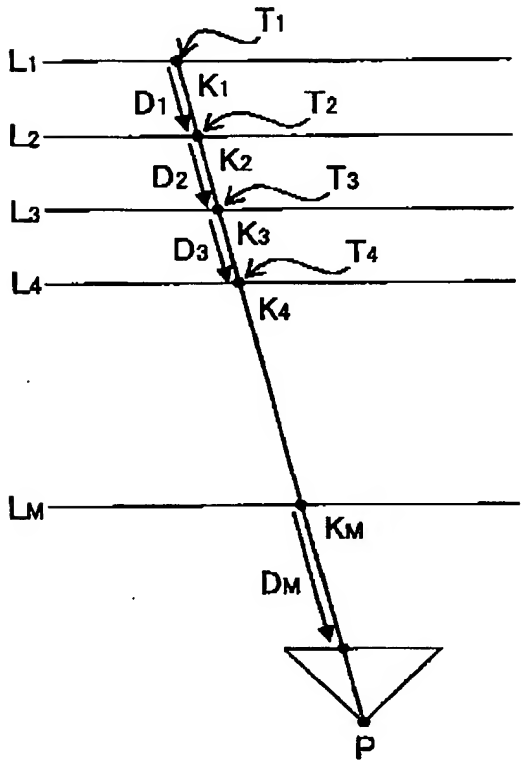

FIG.4B

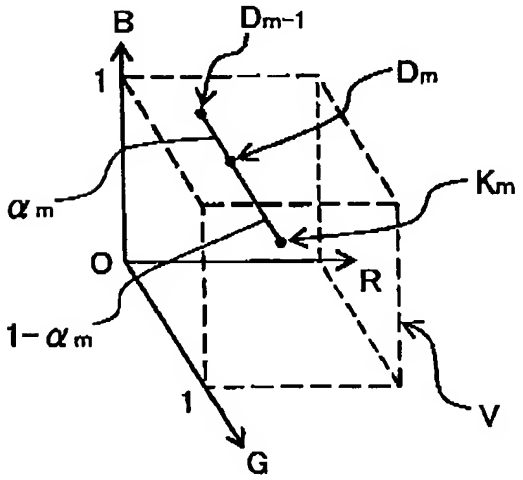

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FIG.5

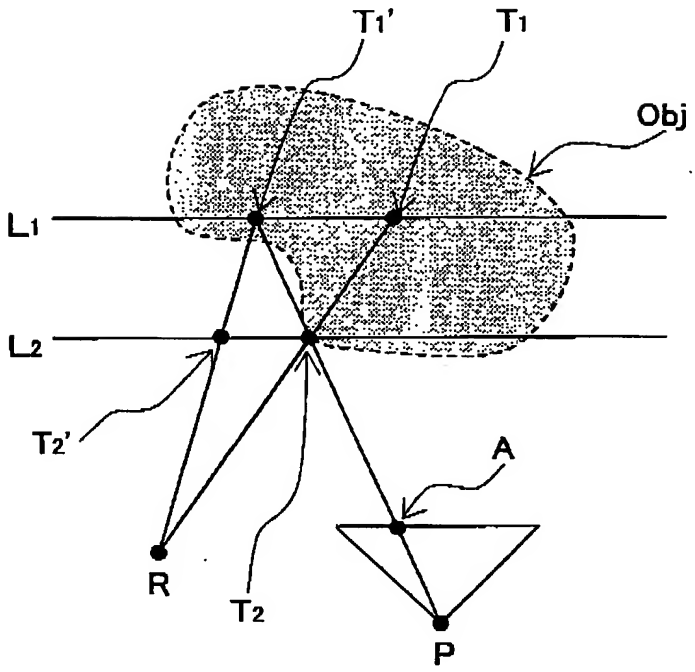

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FIG.6

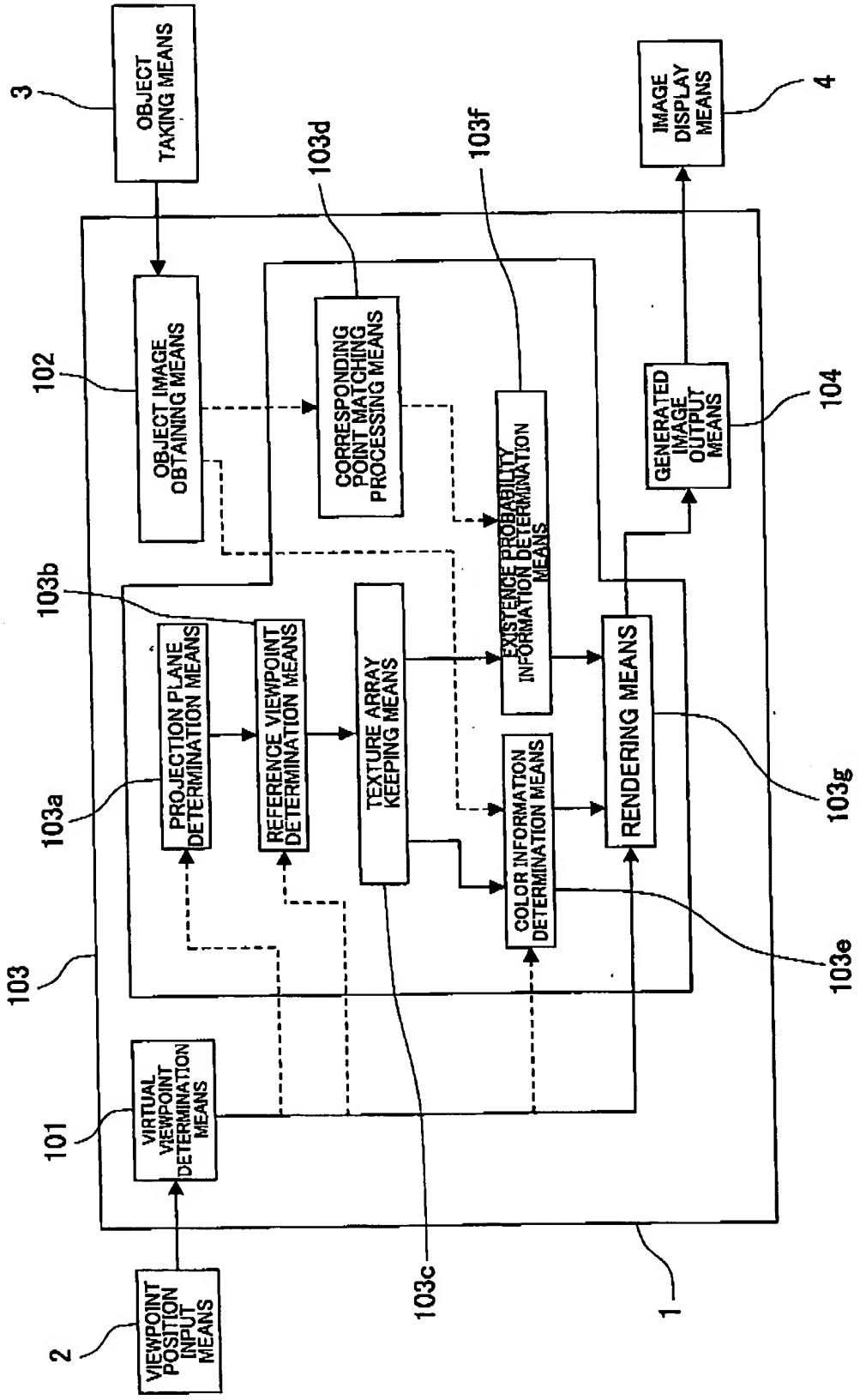

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FIG.7

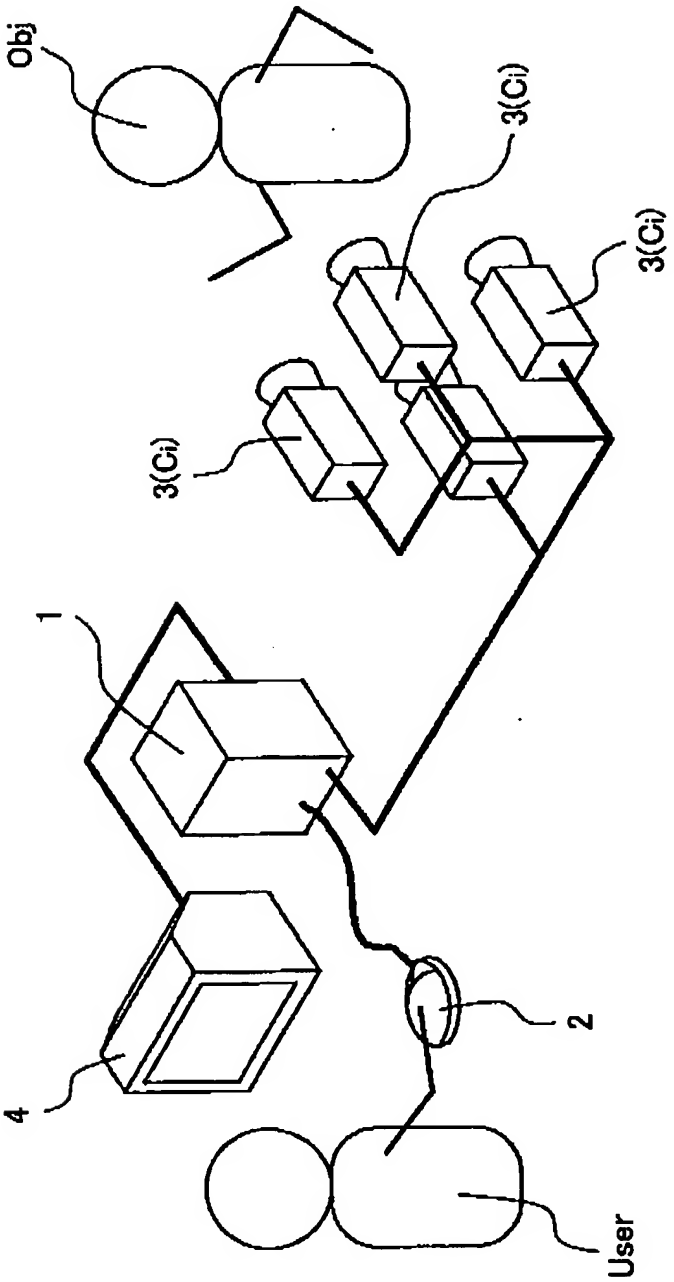

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FIG.8

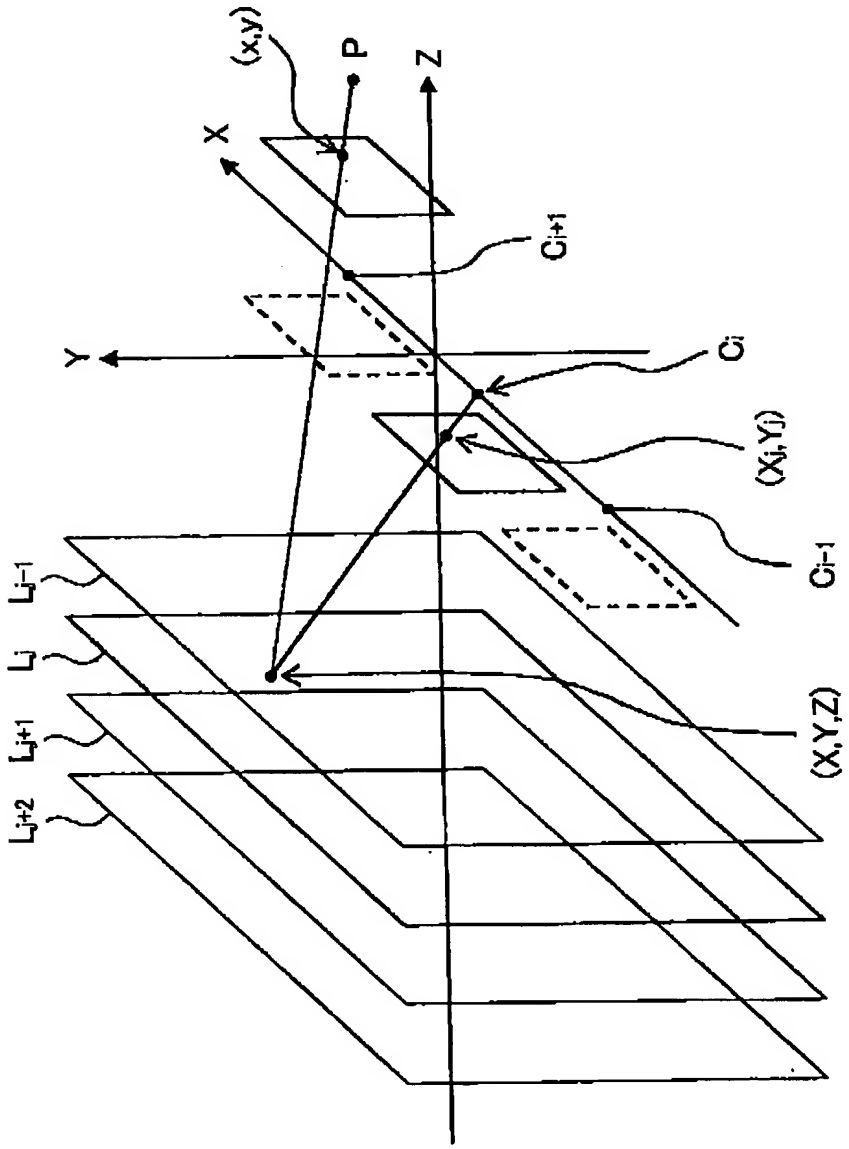

FIG.9A

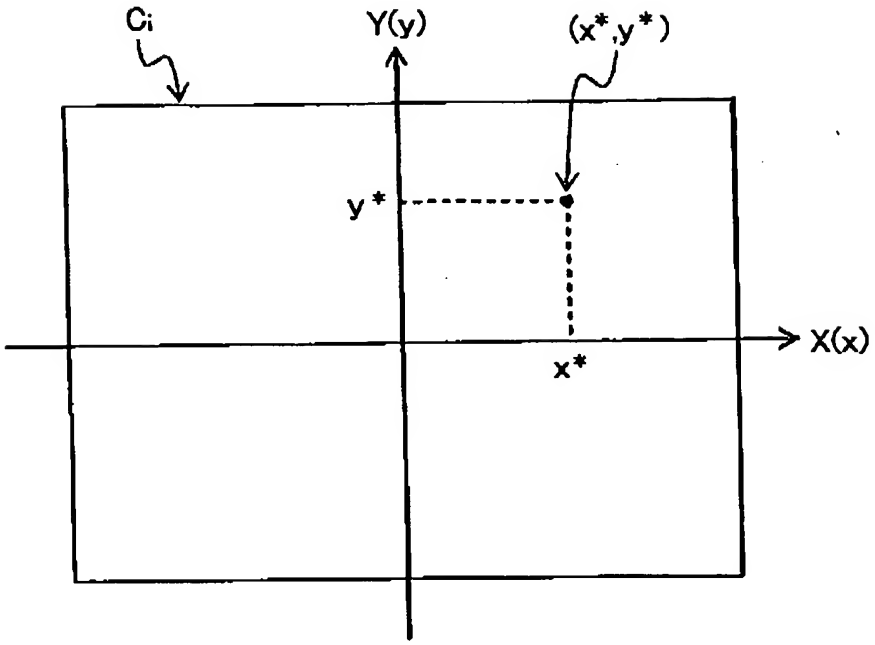

FIG.9B

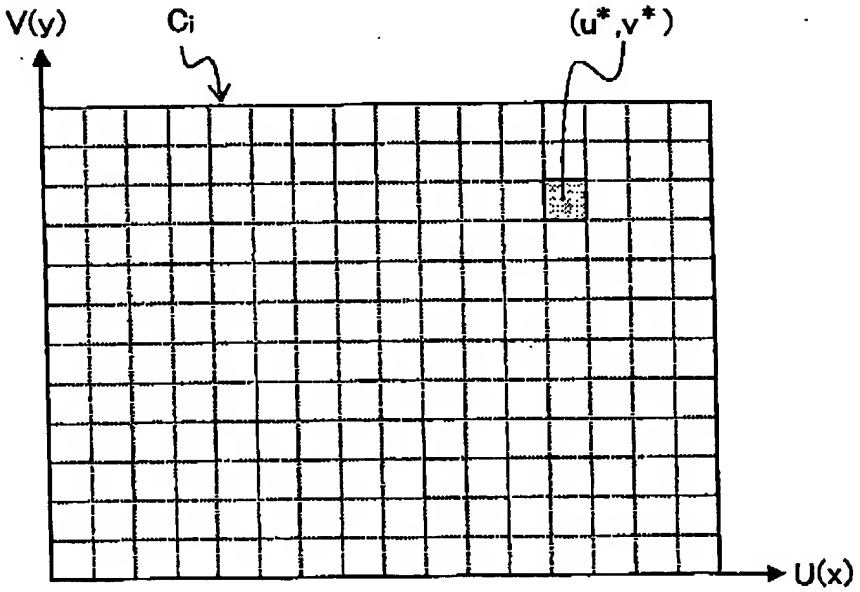

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FIG.10

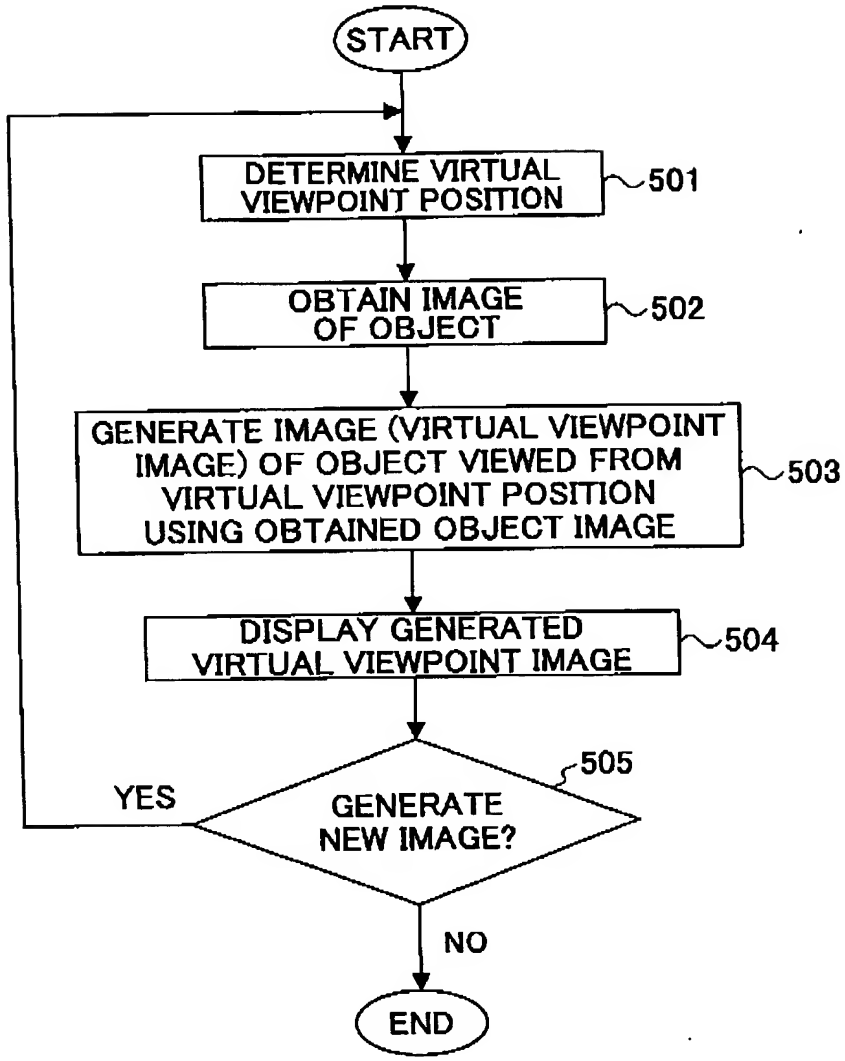

FIG.11

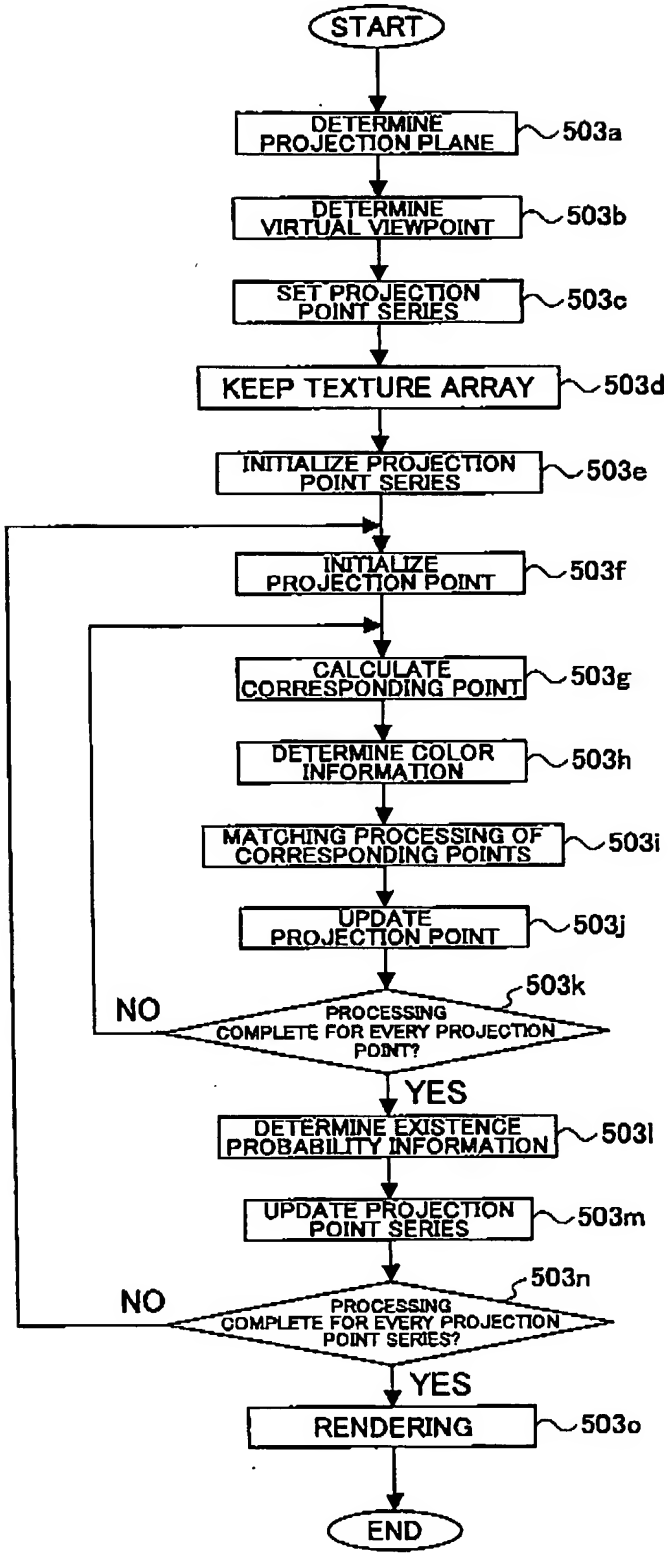
START
DETERMINE PROJECTION PLANE
503a
DETERMINE VIRTUAL VIEWPOINT
503b
SET PROJECTION POINT SERIES
503c
KEEP TEXTURE ARRAY
503d
INITIALIZE PROJECTION POINT SERIES
503e
INITIALIZE PROJECTION POINT
503f
CALCULATE CORRESPONDING POINT
503g
DETERMINE COLOR INFORMATION
503h
MATCHING PROCESSING OF CORRESPONDING POINTS
503i
UPDATE PROJECTION POINT
503j
503k
NO
PROCESSING COMPLETE FOR EVERY PROJECTION POINT?
YES
DETERMINE EXISTENCE PROBABILITY INFORMATION
503l
UPDATE PROJECTION POINT SERIES
503m
503n
NO
PROCESSING COMPLETE FOR EVERY PROJECTION POINT SERIES?
YES
RENDERING
503o
END

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FIG.12

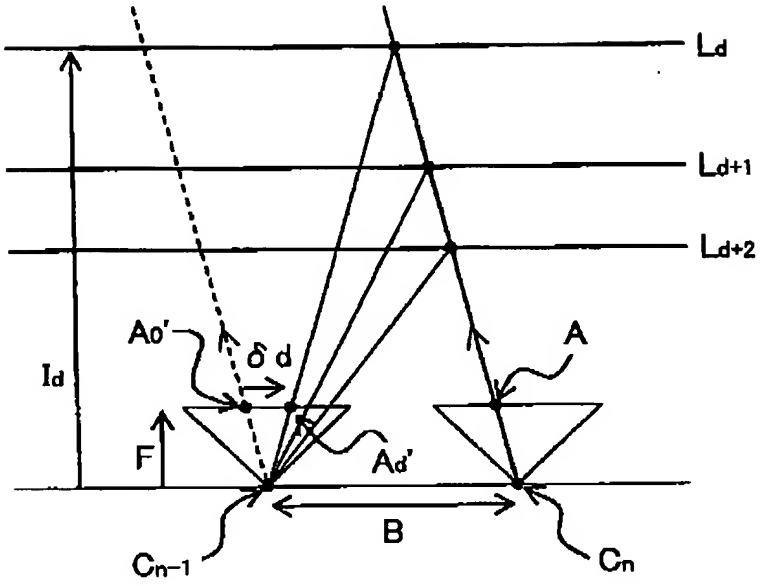

FIG.13

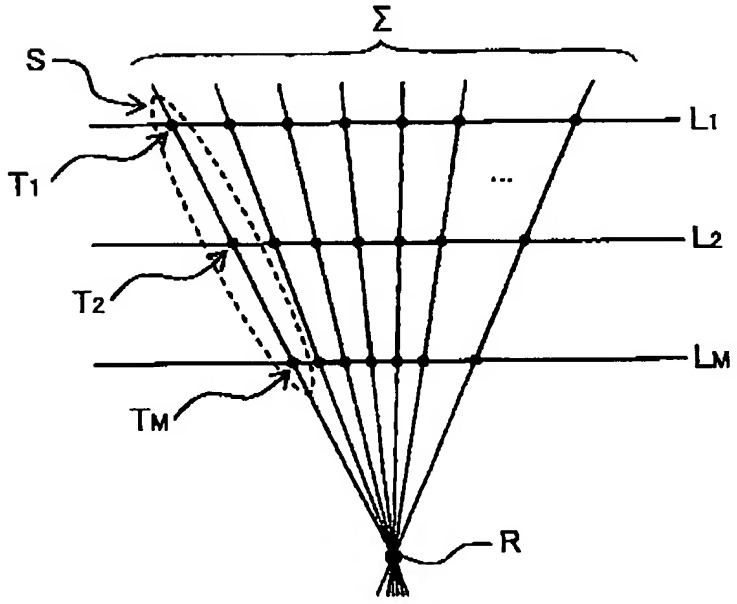

FIG.14

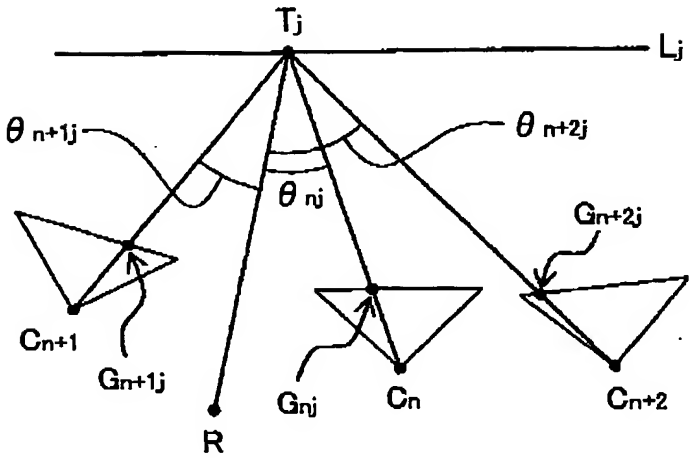
Tj
Lj
θ n+1j
θ n+2j
θ nj
Gn+2j
Cn+1
Gn+1j
Gnj
Cn
Cn+2
R

FIG.15

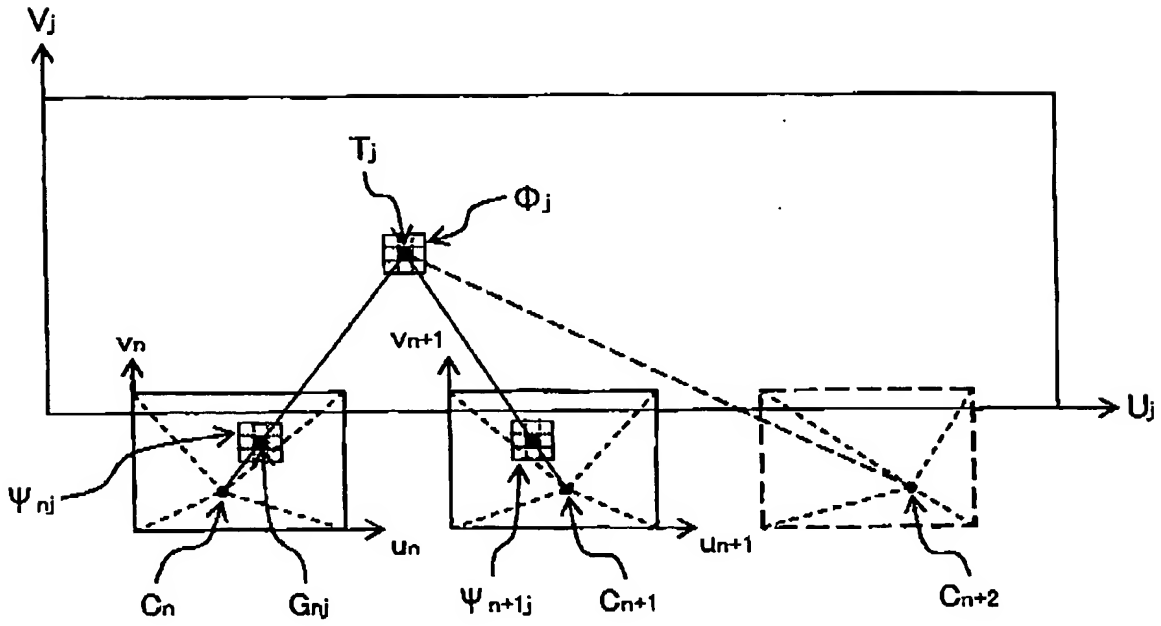
Vj
Tj
Φj
vn
vn+1
Uj
Ψ nj
un
un+1
Cn
Gnj
Ψ n+1j
Cn+1
Cn+2

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FIG.16

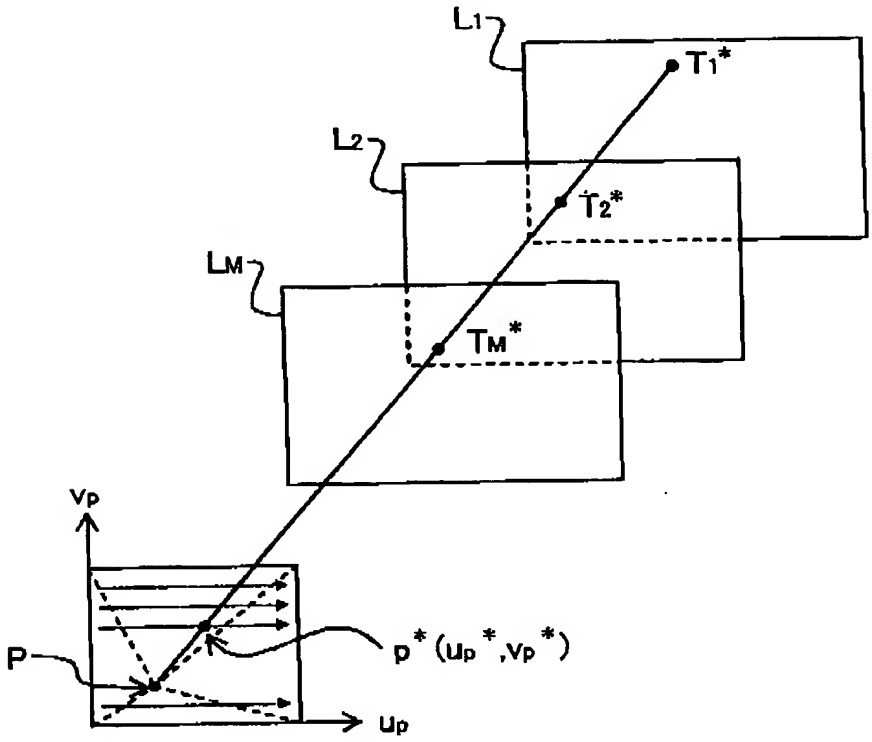

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FIG.17

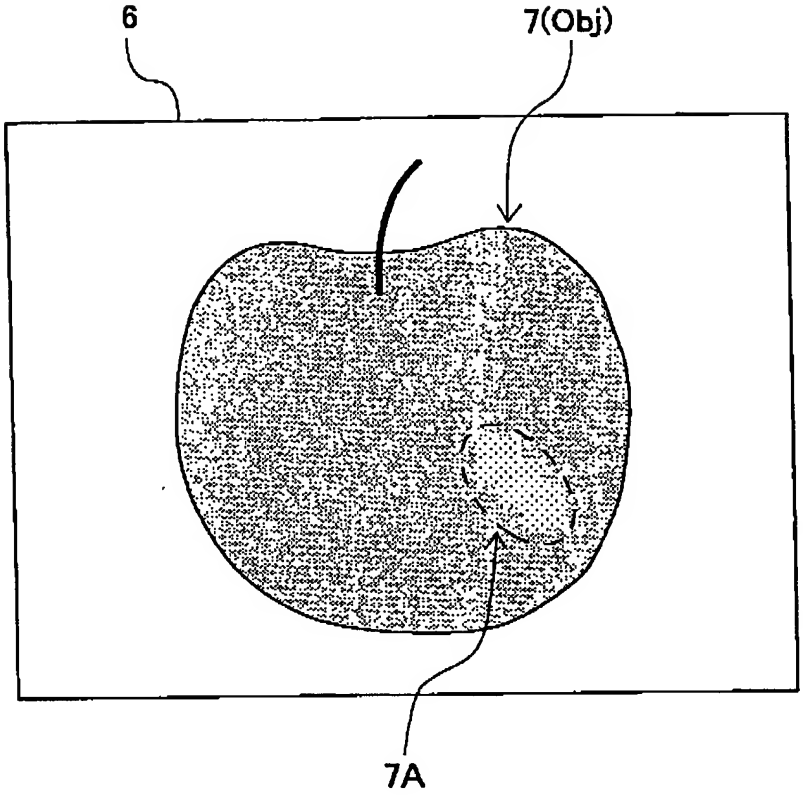

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FIG.18

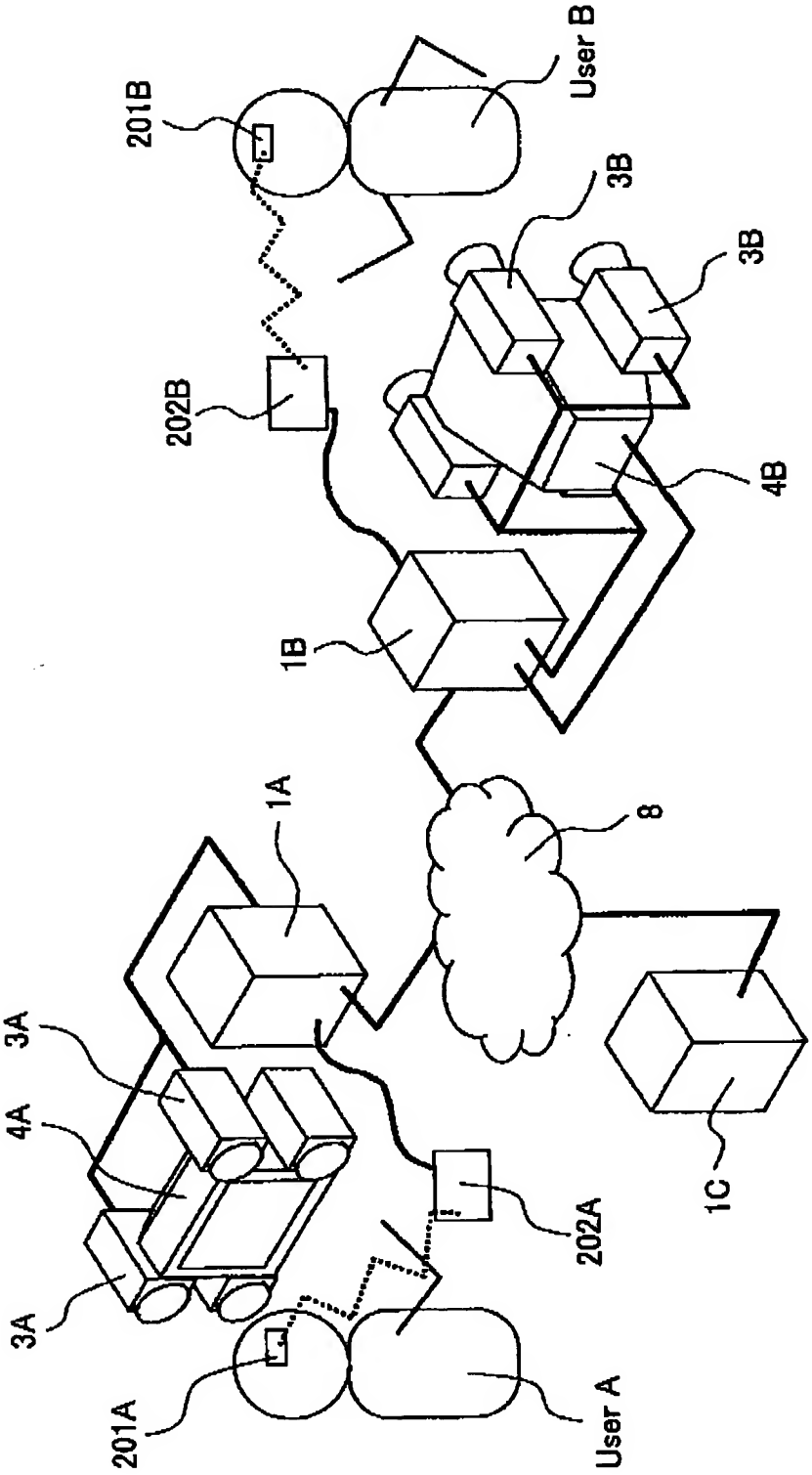

FIG.19A

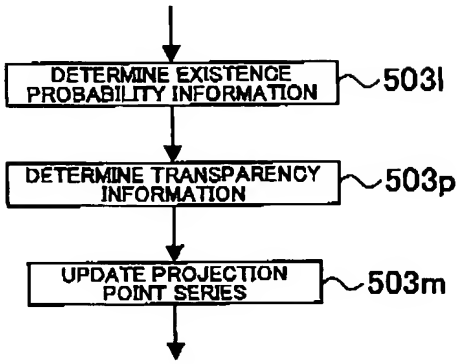

FIG.19B

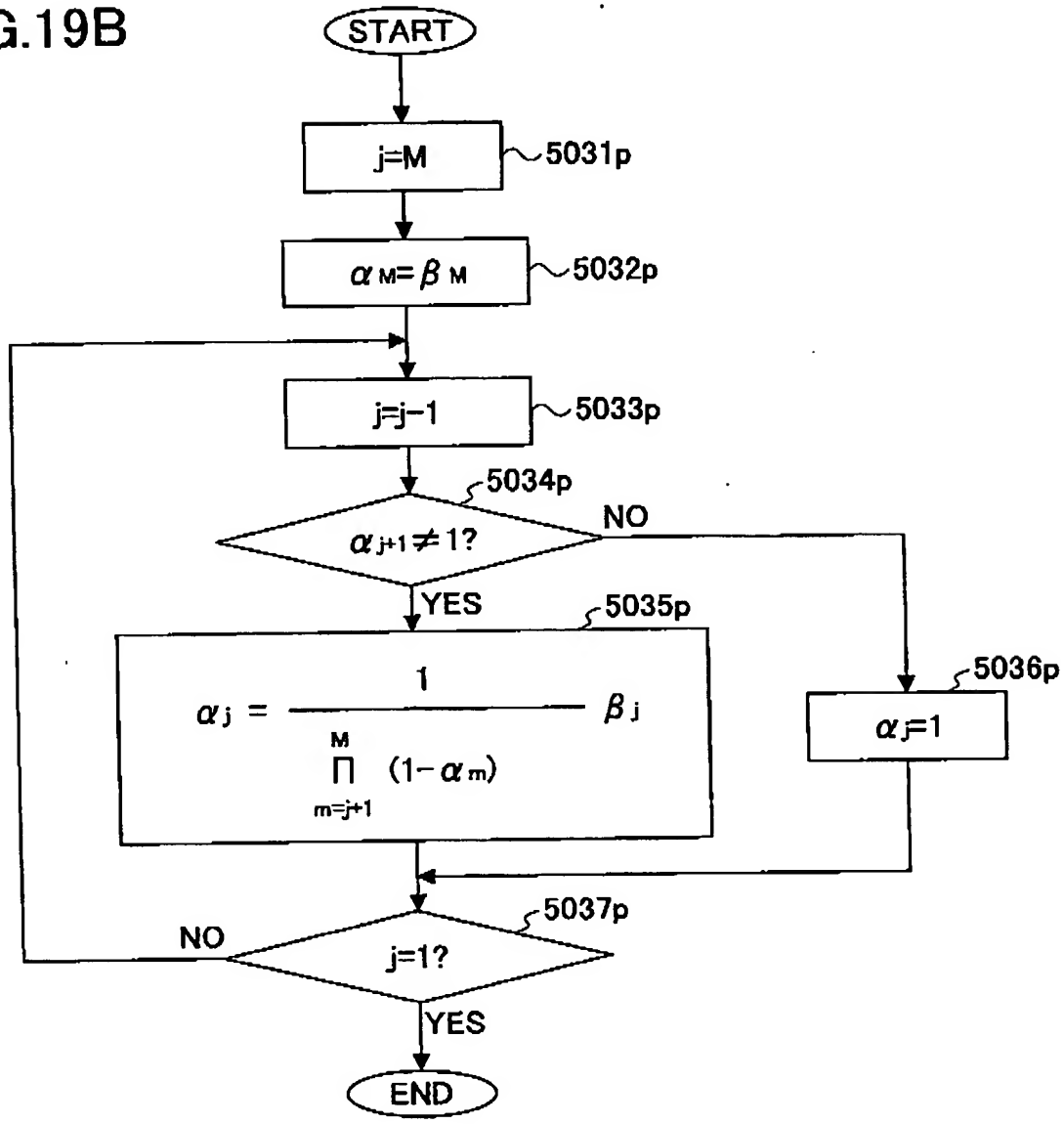

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FIG.20

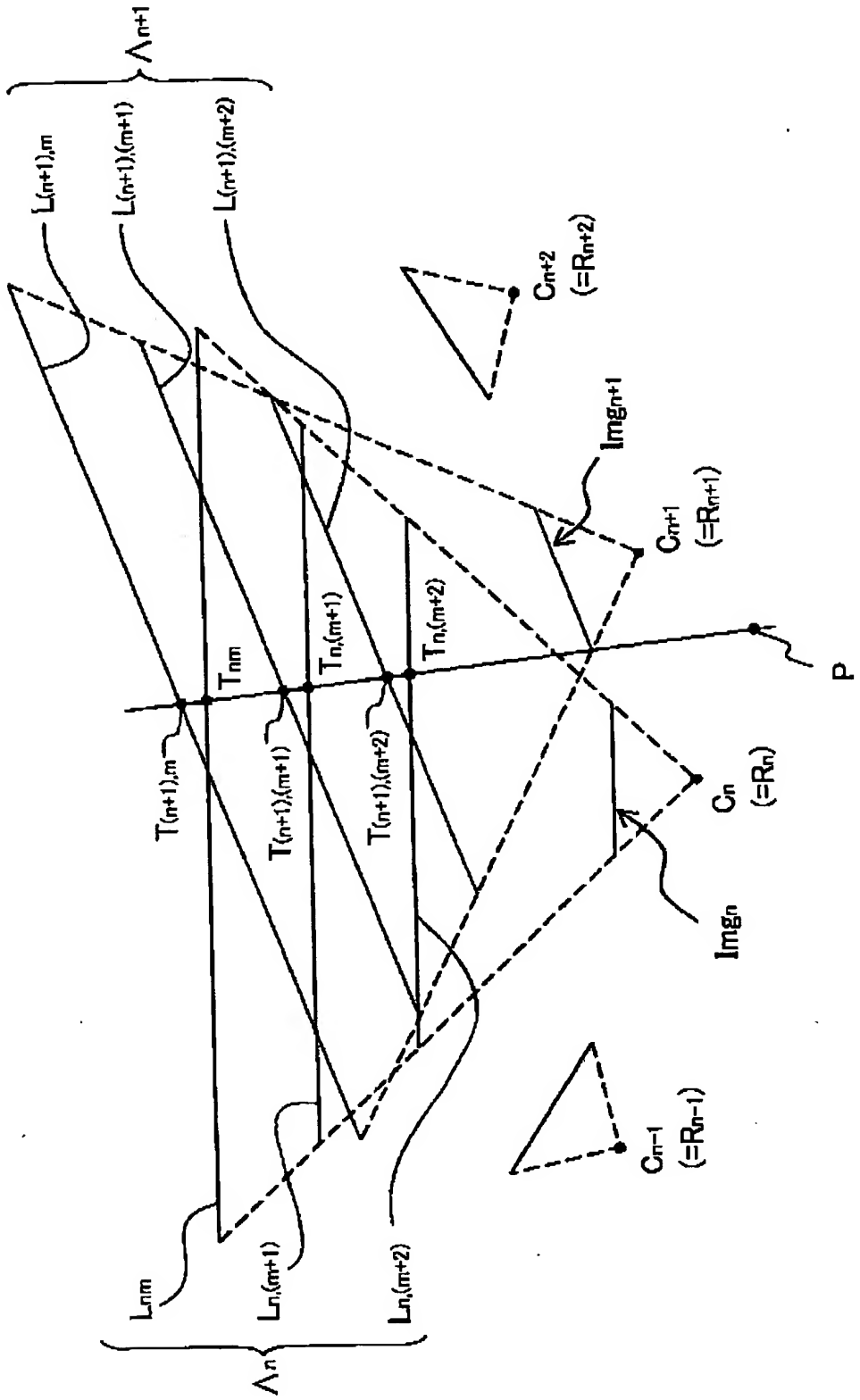

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FIG.21

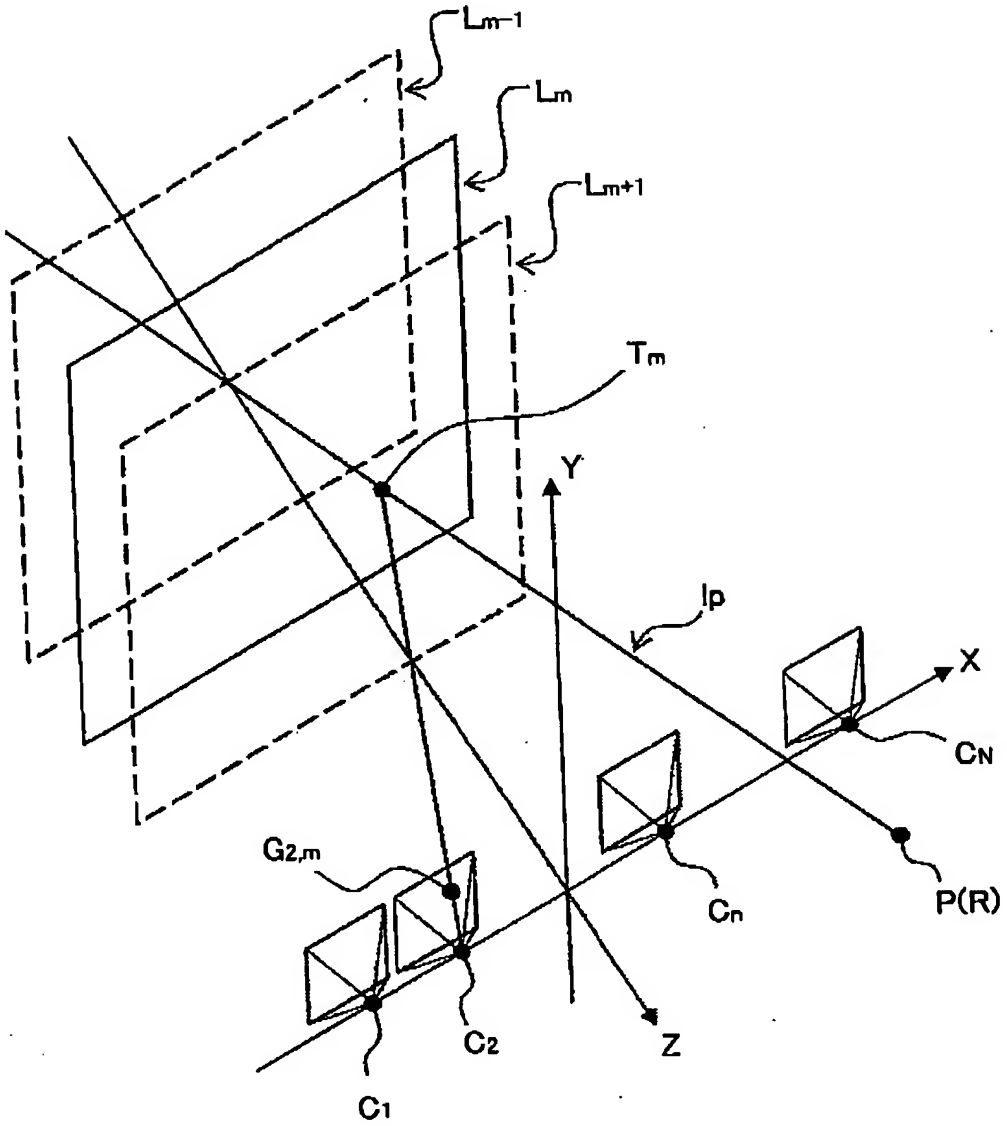

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FIG.22

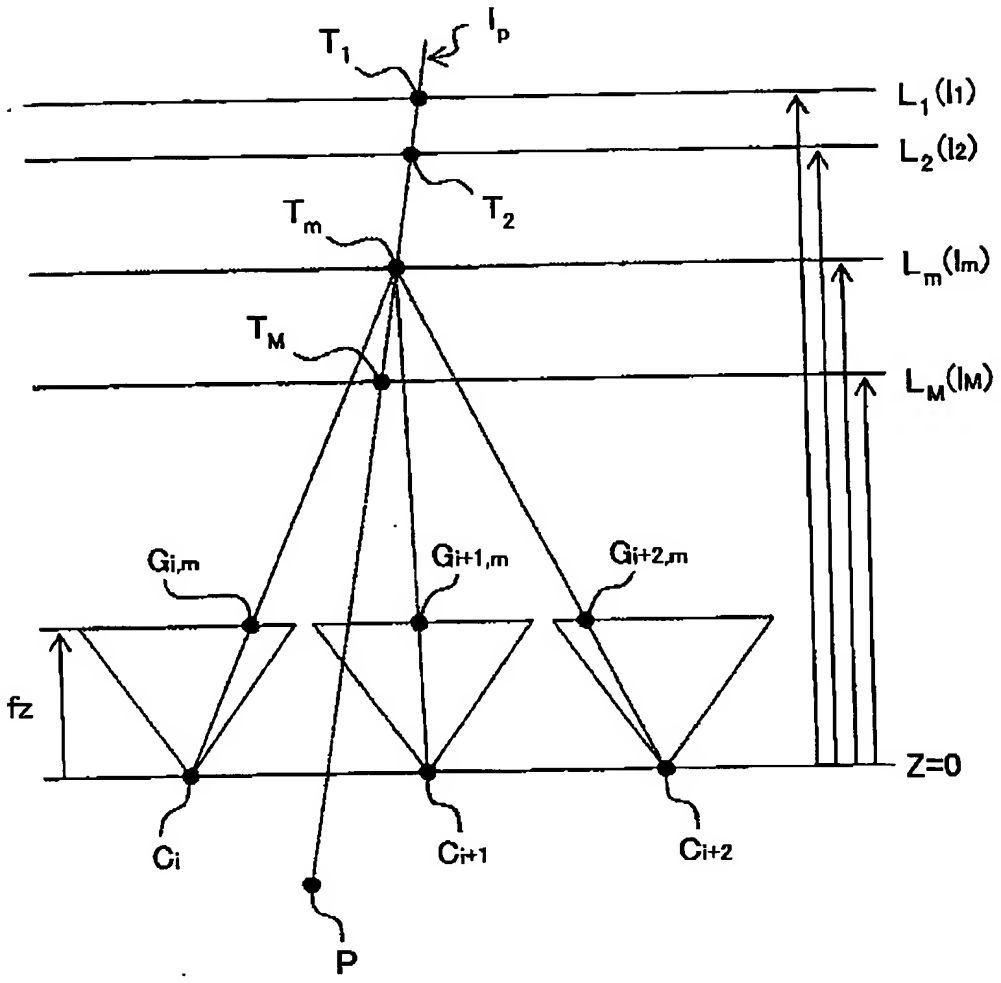

FIG.23A

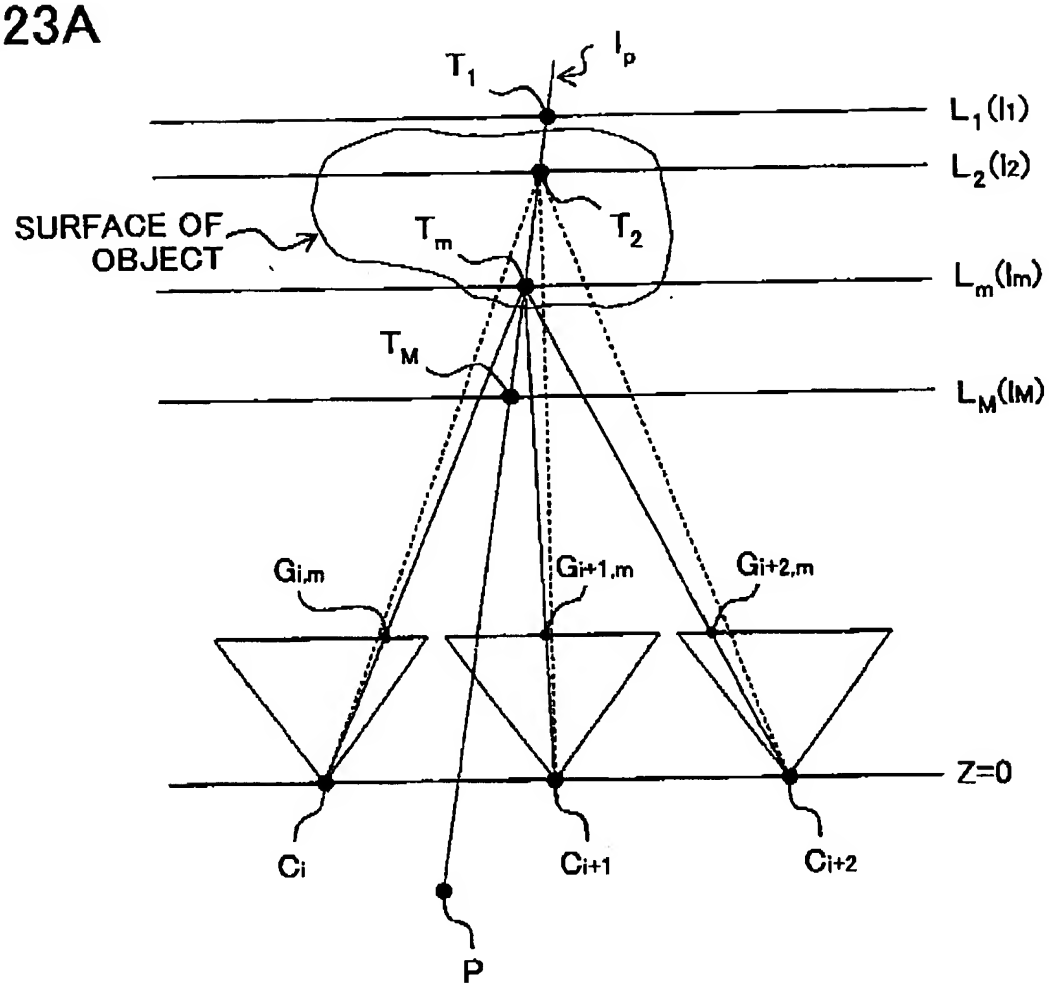

FIG.23B

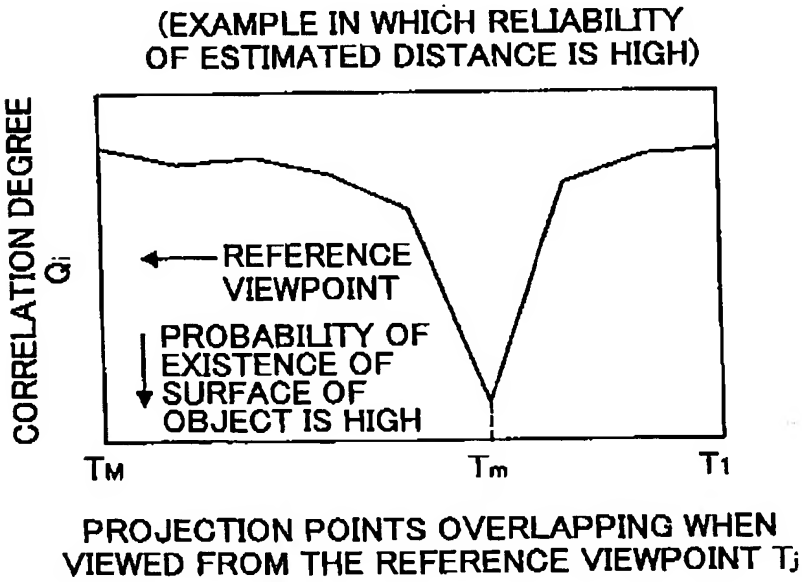

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FIG.24A

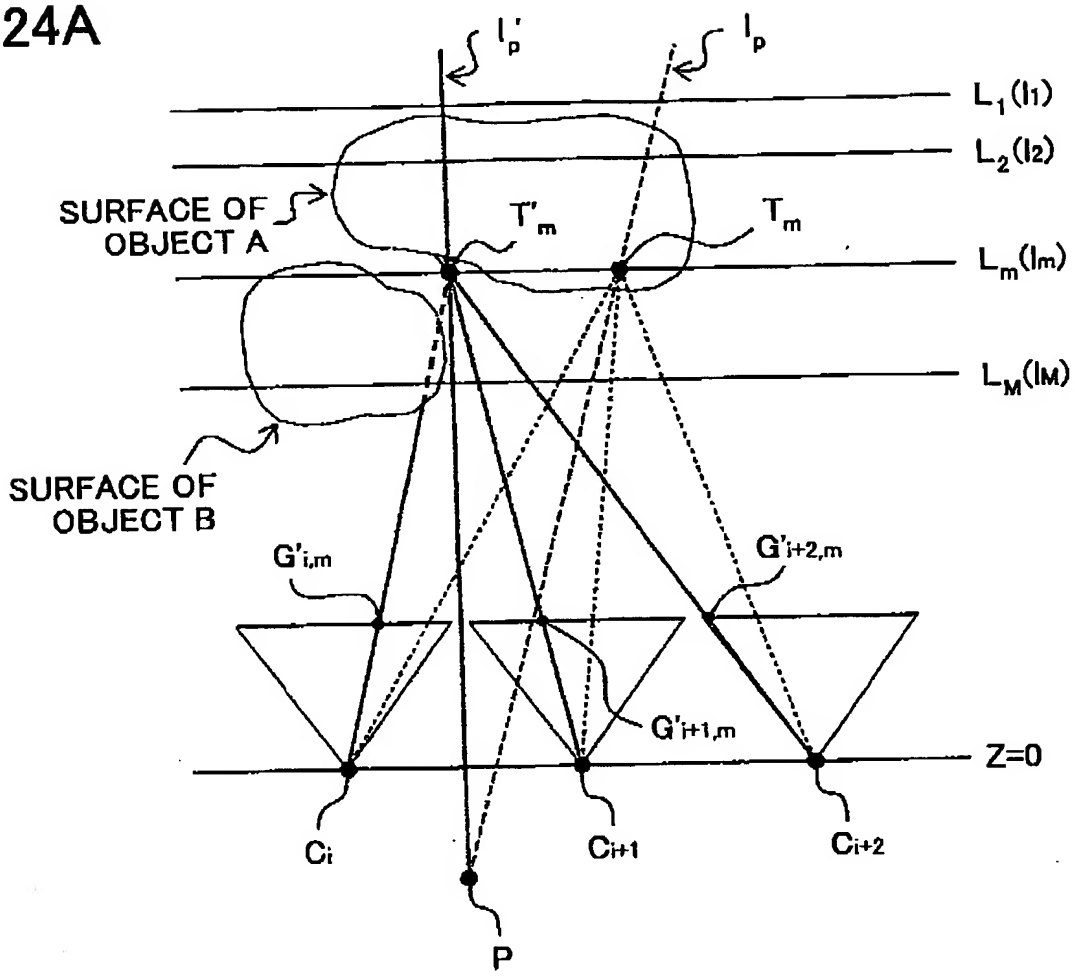

FIG.24B

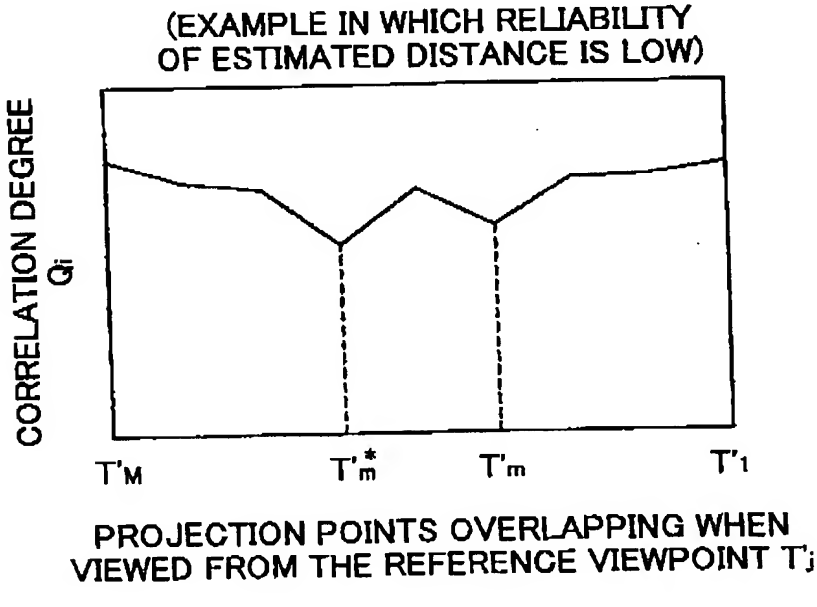

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FIG.25

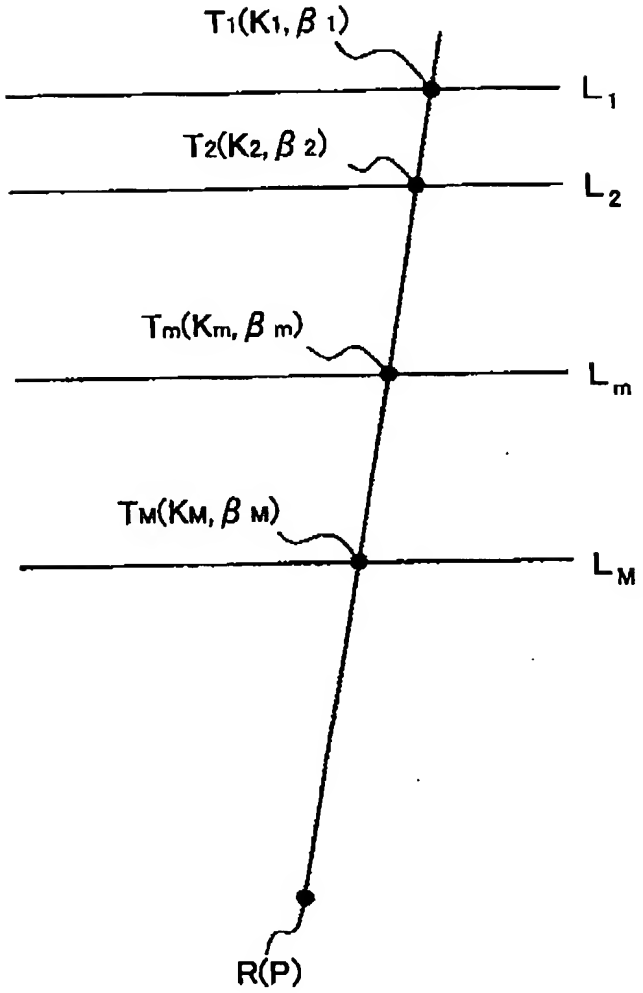

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FIG.26A

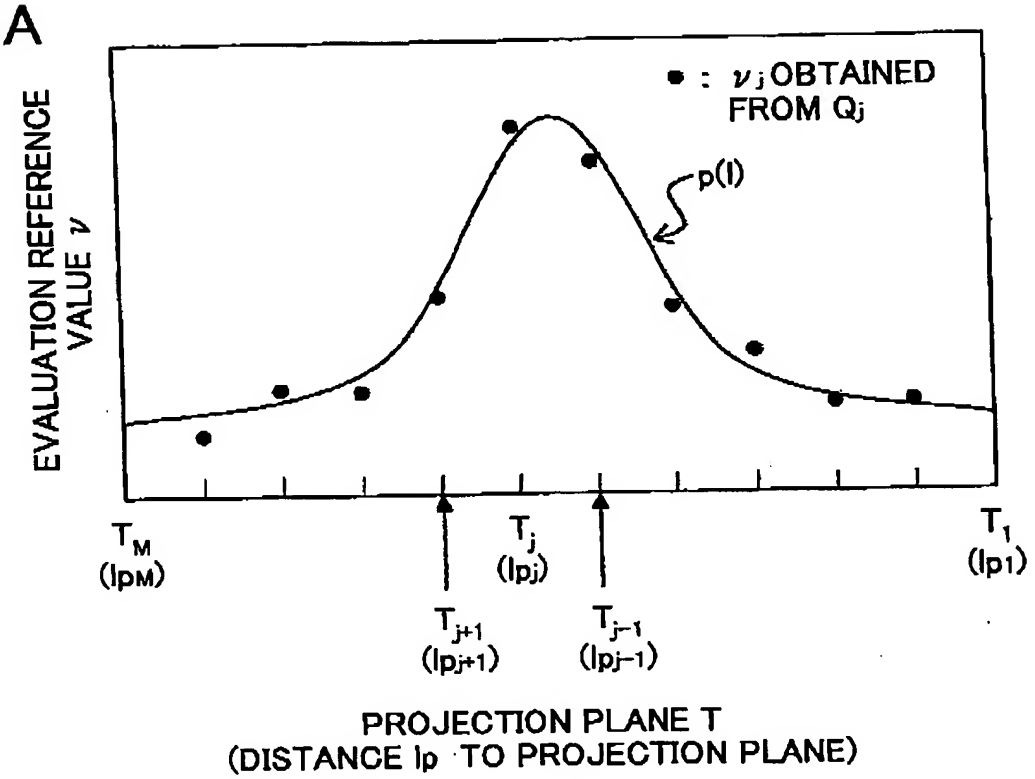


FIG.26B

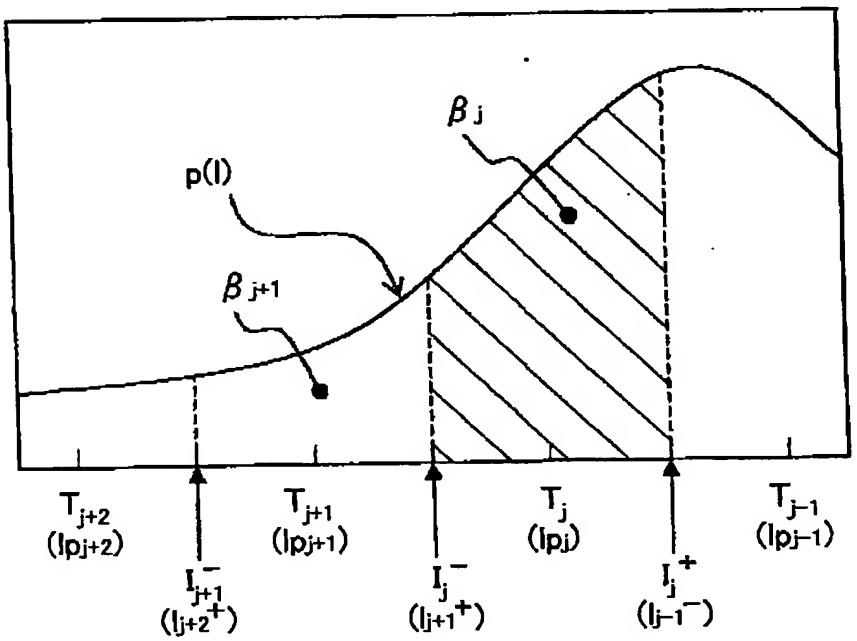


FIG.27A

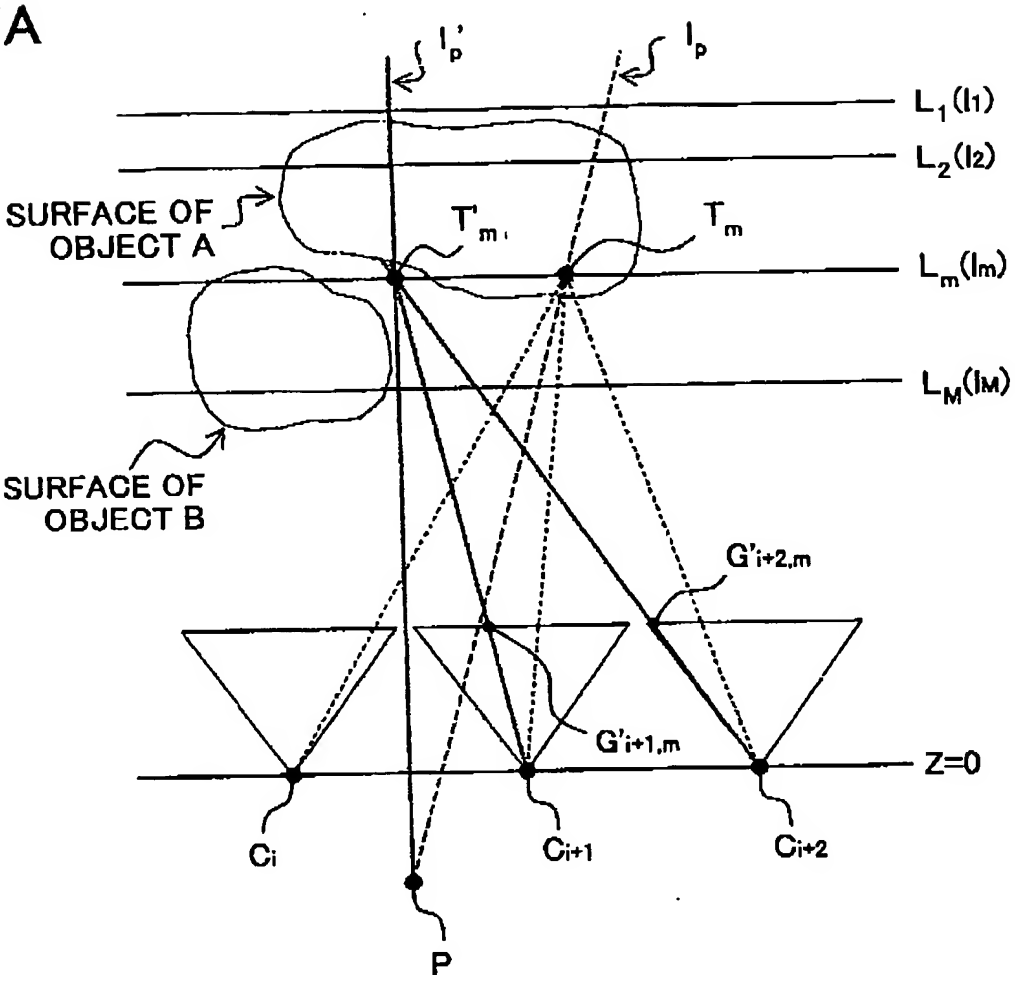
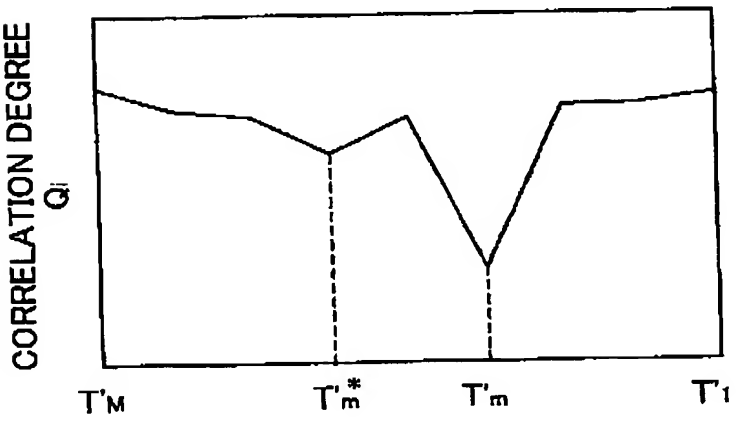


FIG.27B



PROJECTION POINTS OVERLAPPING WHEN VIEWED FROM THE REFERENCE VIEWPOINT T'j

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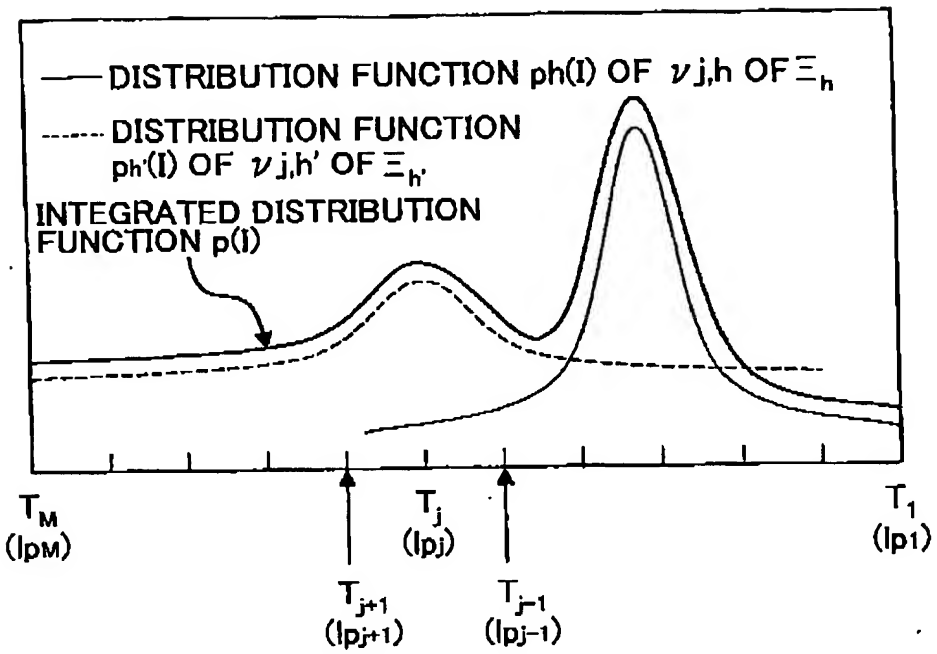
FIG.28



PROJECTION PLANE T
(DISTANCE lp TO PROJECTION PLANE)

FIG.29

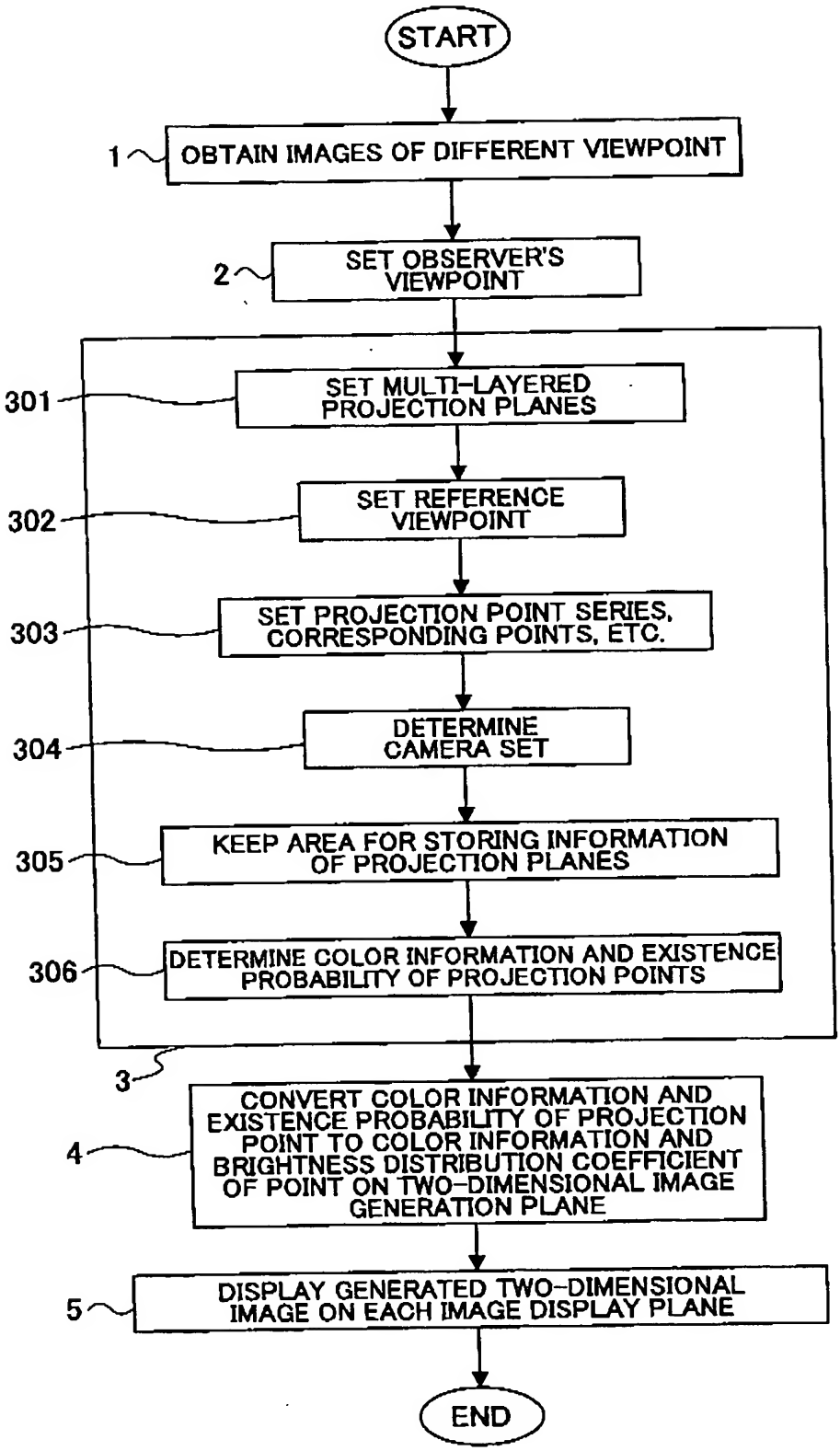

START
1
OBTAIN IMAGES OF DIFFERENT VIEWPOINT
2
SET OBSERVER'S VIEWPOINT
301
SET MULTI-LAYERED PROJECTION PLANES
302
SET REFERENCE VIEWPOINT
303
SET PROJECTION POINT SERIES, CORRESPONDING POINTS, ETC.
304
DETERMINE CAMERA SET
305
KEEP AREA FOR STORING INFORMATION OF PROJECTION PLANES
306
DETERMINE COLOR INFORMATION AND EXISTENCE PROBABILITY OF PROJECTION POINTS
3
4
CONVERT COLOR INFORMATION AND EXISTENCE PROBABILITY OF PROJECTION POINT TO COLOR INFORMATION AND BRIGHTNESS DISTRIBUTION COEFFICIENT OF POINT ON TWO-DIMENSIONAL IMAGE GENERATION PLANE
5
DISPLAY GENERATED TWO-DIMENSIONAL IMAGE ON EACH IMAGE DISPLAY PLANE
END

FIG.30

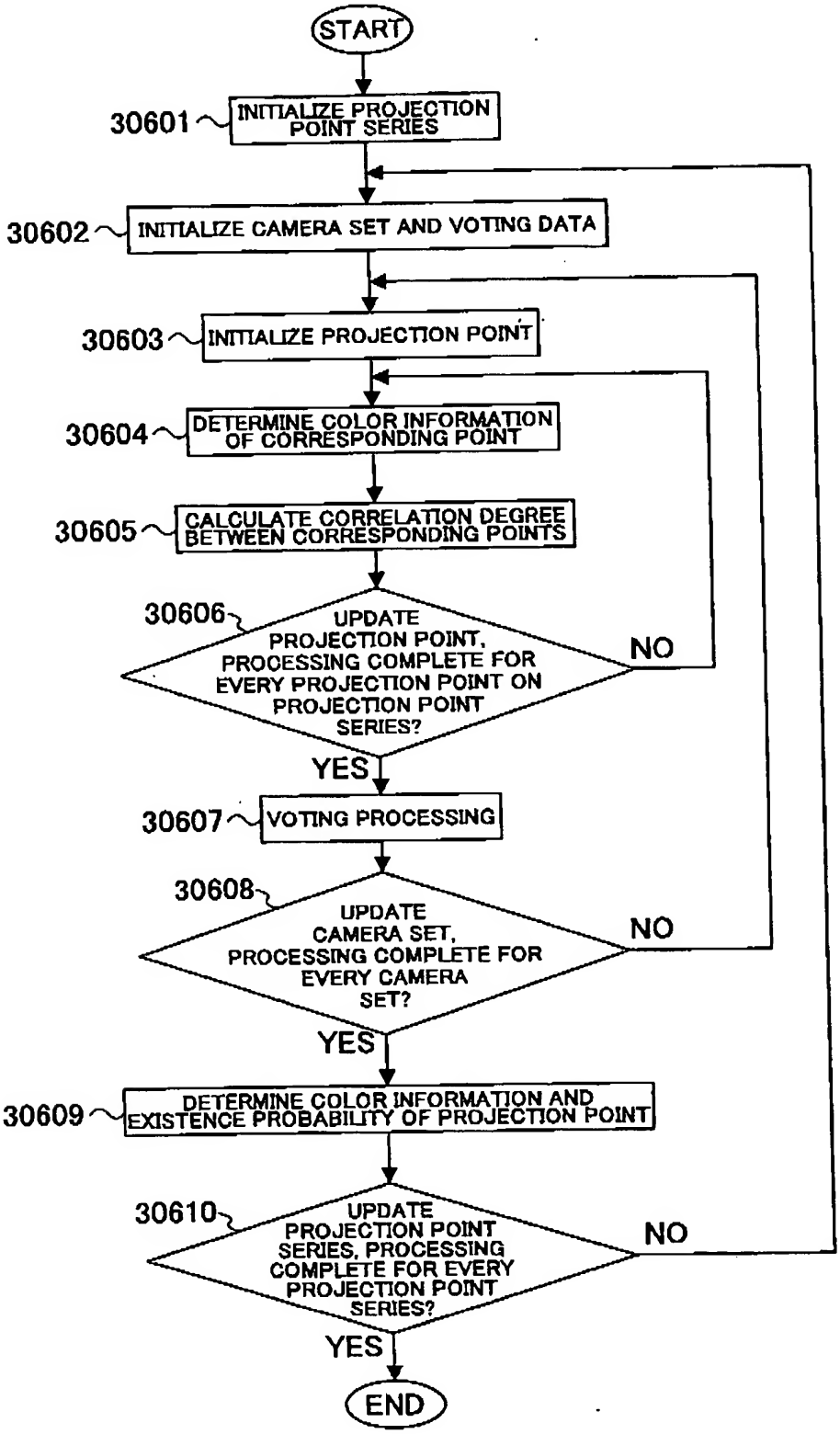

START
30601
INITIALIZE PROJECTION POINT SERIES
30602
INITIALIZE CAMERA SET AND VOTING DATA
30603
INITIALIZE PROJECTION POINT
30604
DETERMINE COLOR INFORMATION OF CORRESPONDING POINT
30605
CALCULATE CORRELATION DEGREE BETWEEN CORRESPONDING POINTS
30606
UPDATE PROJECTION POINT, PROCESSING COMPLETE FOR EVERY PROJECTION POINT ON PROJECTION POINT SERIES?
NO
YES
30607
VOTING PROCESSING
30608
UPDATE CAMERA SET, PROCESSING COMPLETE FOR EVERY CAMERA SET?
NO
YES
30609
DETERMINE COLOR INFORMATION AND EXISTENCE PROBABILITY OF PROJECTION POINT
30610
UPDATE PROJECTION POINT SERIES, PROCESSING COMPLETE FOR EVERY PROJECTION POINT SERIES?
NO
YES
END

FIG.31

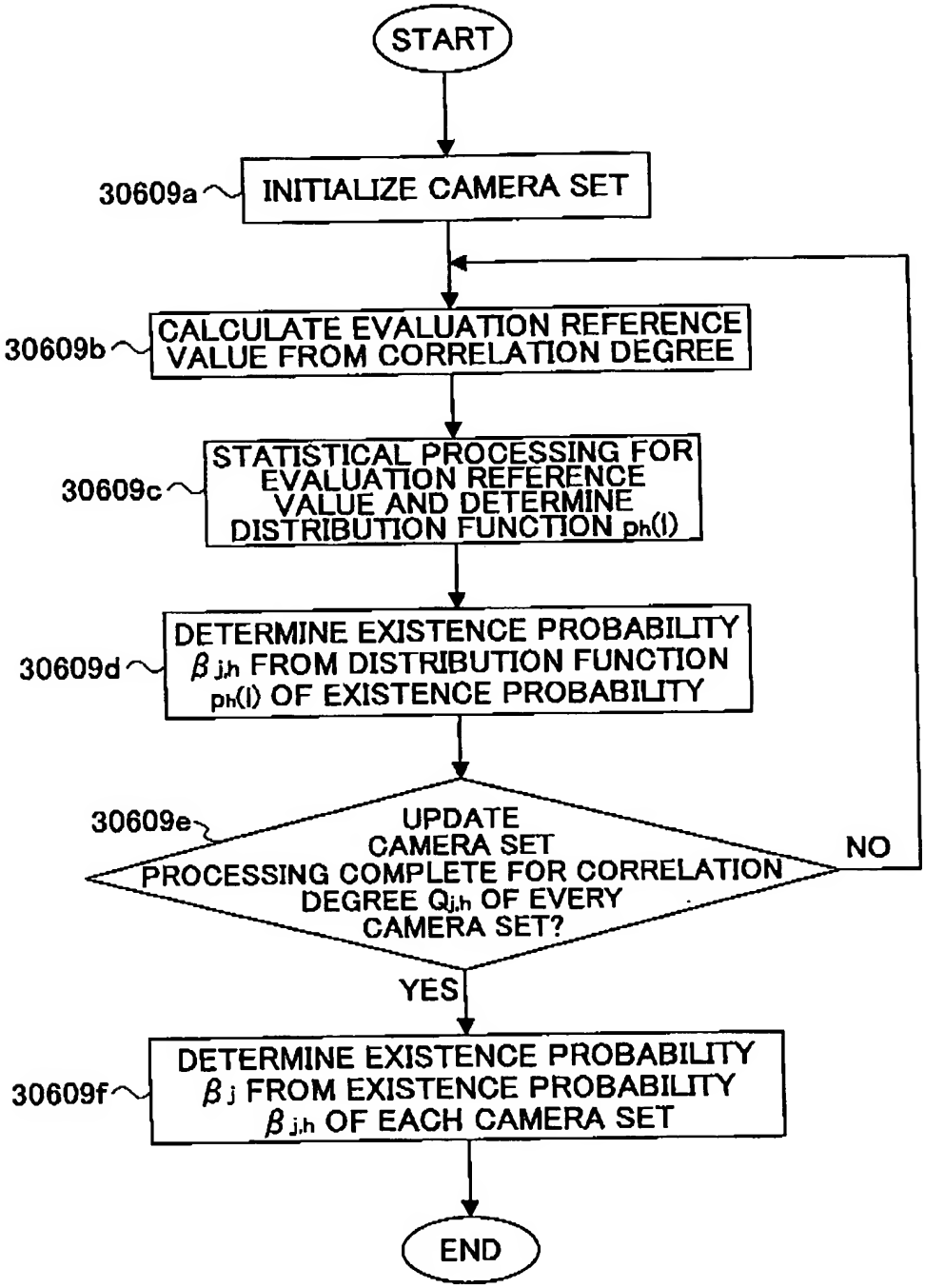

START
30609a
INITIALIZE CAMERA SET
30609b
CALCULATE EVALUATION REFERENCE VALUE FROM CORRELATION DEGREE
30609c
STATISTICAL PROCESSING FOR EVALUATION REFERENCE VALUE AND DETERMINE DISTRIBUTION FUNCTION ph(I)
30609d
DETERMINE EXISTENCE PROBABILITY βj,h FROM DISTRIBUTION FUNCTION ph(I) OF EXISTENCE PROBABILITY
30609e
UPDATE CAMERA SET
PROCESSING COMPLETE FOR CORRELATION DEGREE Qj,h OF EVERY CAMERA SET?
NO
YES
30609f
DETERMINE EXISTENCE PROBABILITY βj FROM EXISTENCE PROBABILITY βj,h OF EACH CAMERA SET
END

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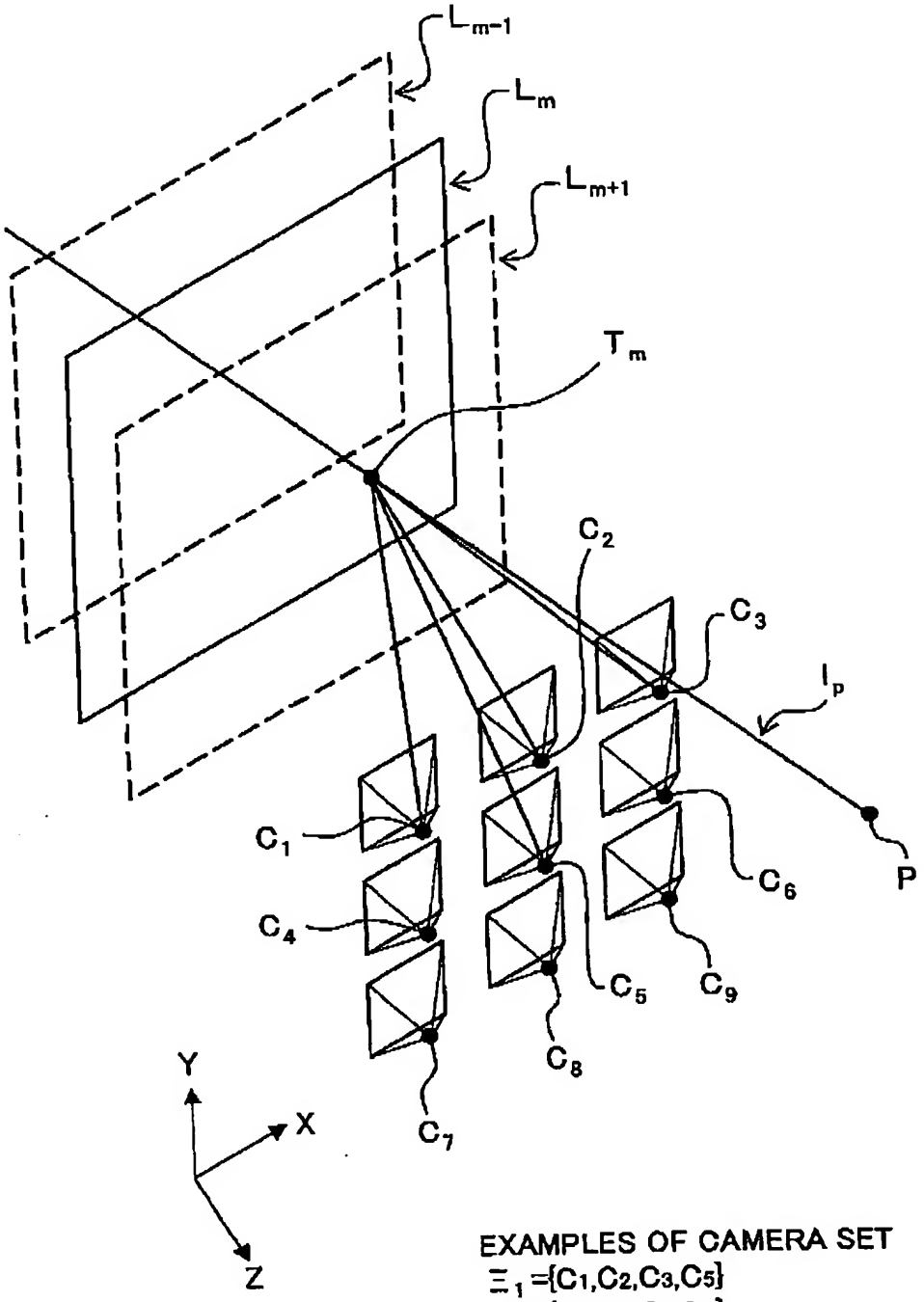
FIG.32



EXAMPLES OF CAMERA SET

$\Xi_1 = \{C_1, C_2, C_3, C_5\}$
$\Xi_2 = \{C_3, C_5, C_6, C_9\}$
$\Xi_3 = \{C_5, C_7, C_8, C_9\}$
$\Xi_4 = \{C_1, C_4, C_5, C_7\}$

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FIG.33

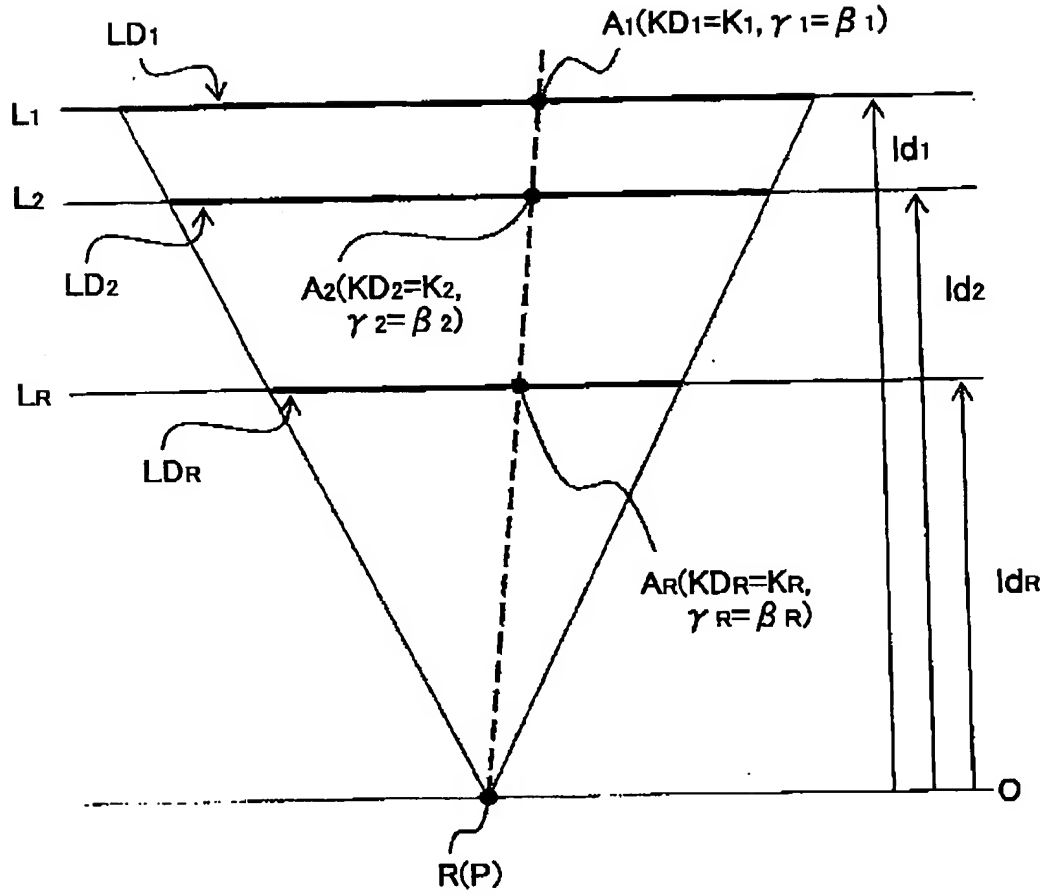

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FIG.34A

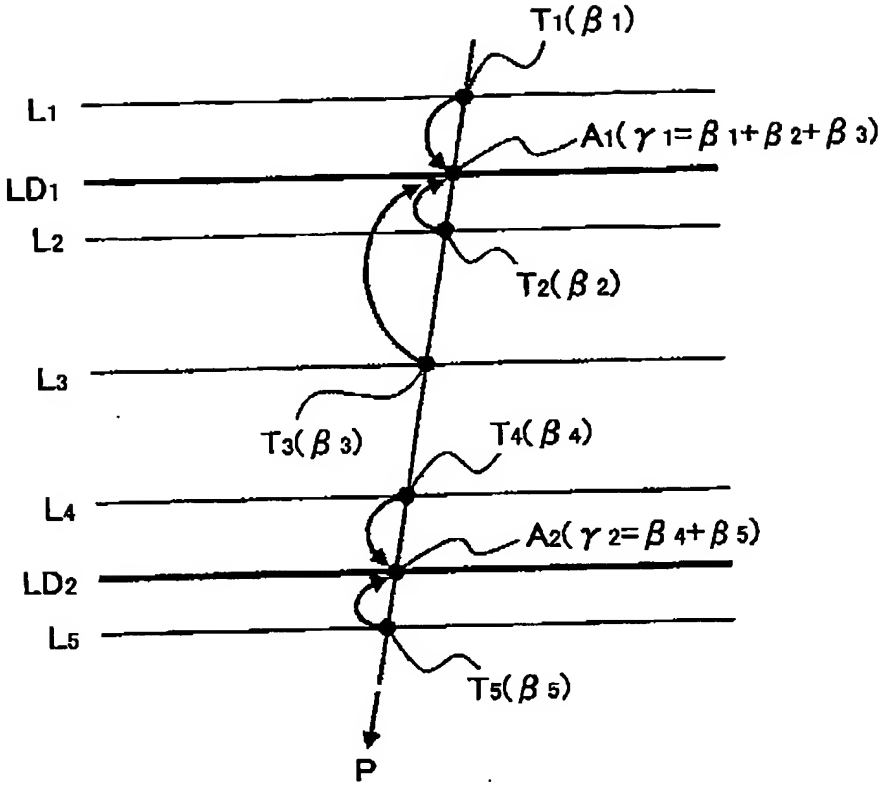

FIG.34B

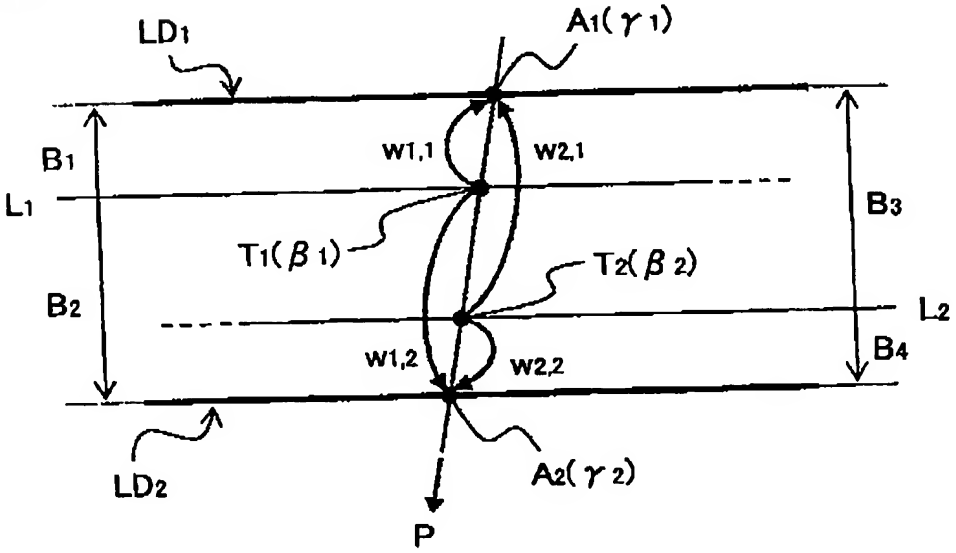

FIG.35

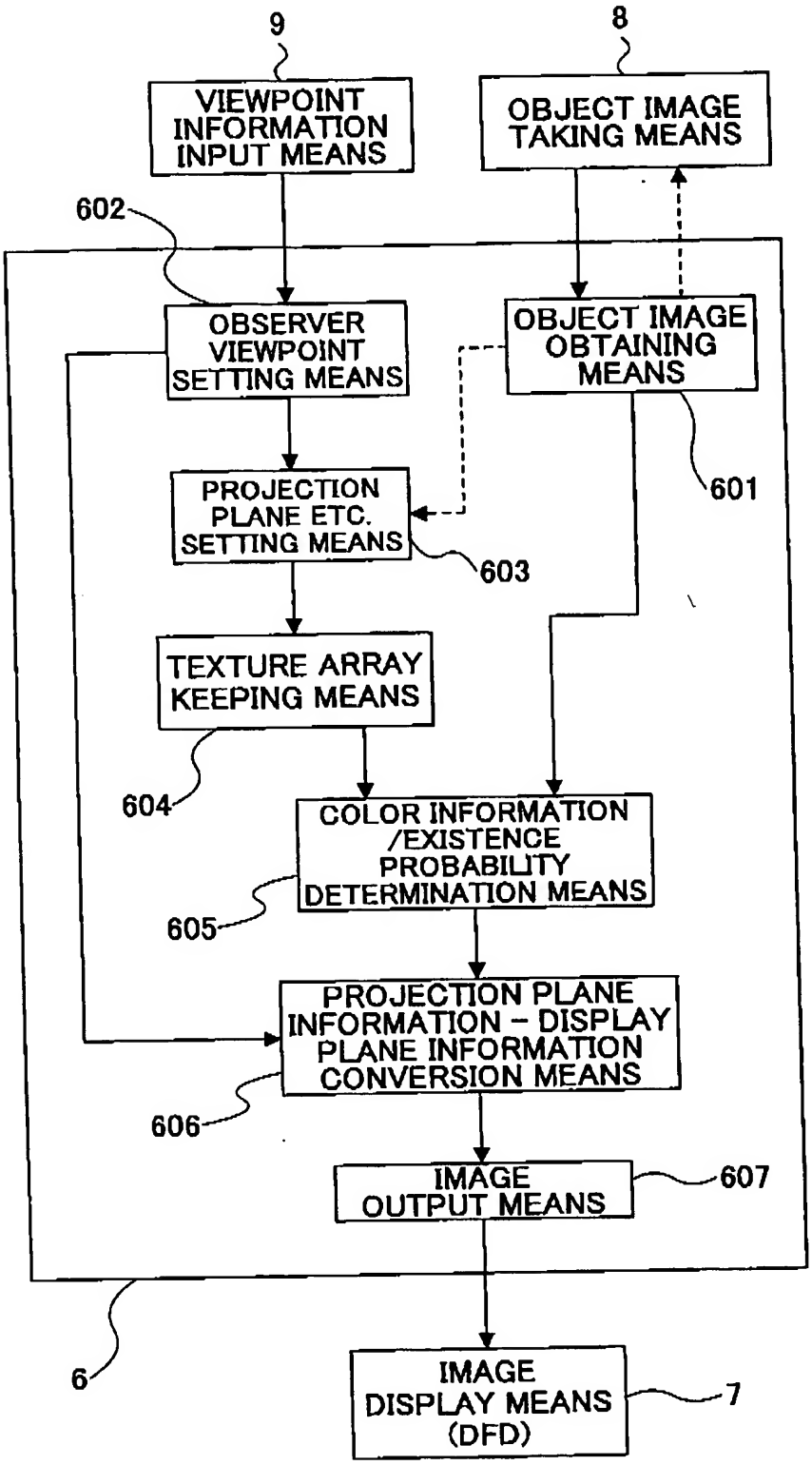
9
8
VIEWPOINT INFORMATION INPUT MEANS
OBJECT IMAGE TAKING MEANS
602
OBSERVER VIEWPOINT SETTING MEANS
OBJECT IMAGE OBTAINING MEANS
601
PROJECTION PLANE ETC. SETTING MEANS
603
TEXTURE ARRAY KEEPING MEANS
604
COLOR INFORMATION /EXISTENCE PROBABILITY DETERMINATION MEANS
605
PROJECTION PLANE INFORMATION – DISPLAY PLANE INFORMATION CONVERSION MEANS
606
IMAGE OUTPUT MEANS
607
6
IMAGE DISPLAY MEANS (DFD)
7

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FIG.36

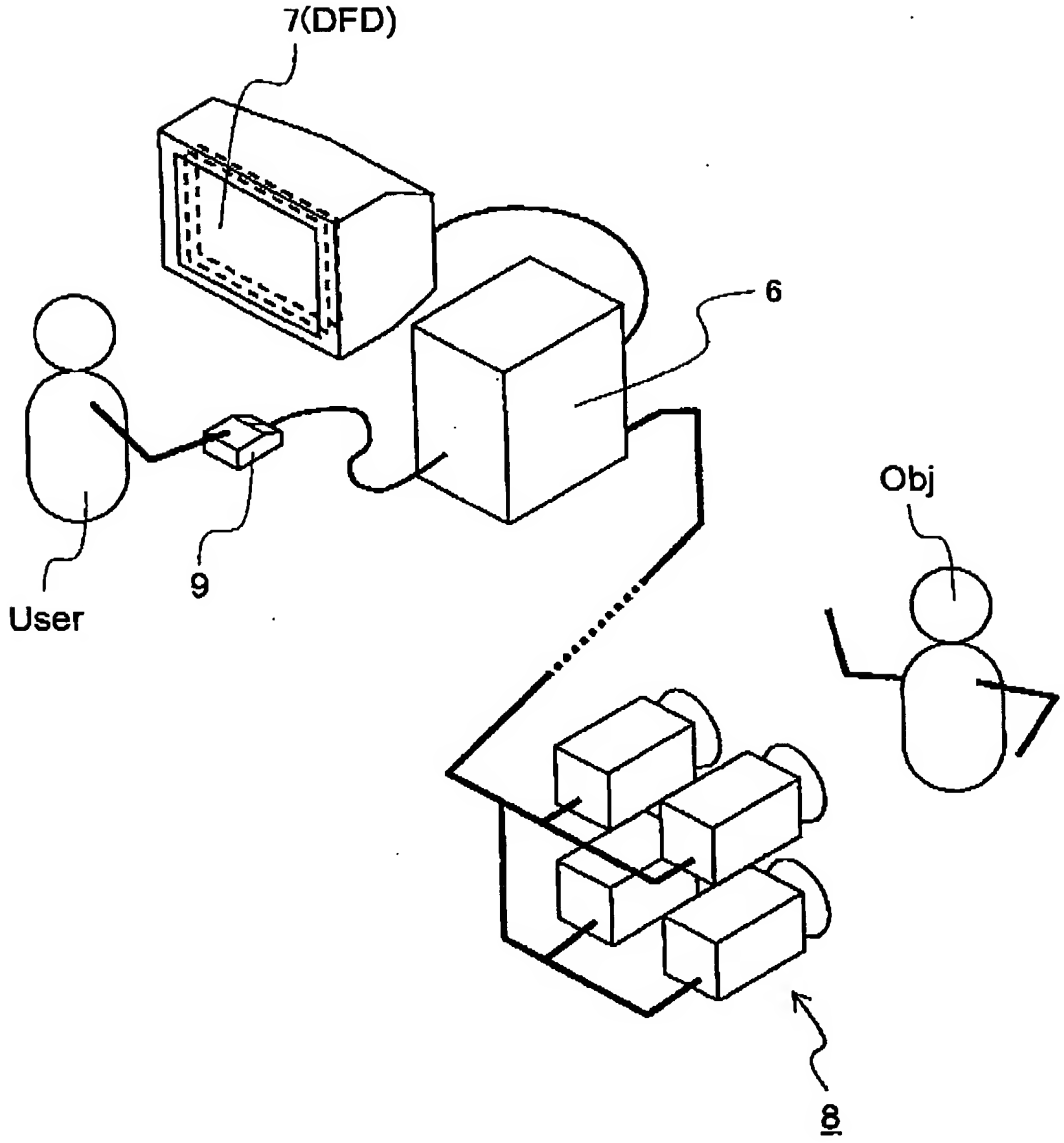

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FIG.37

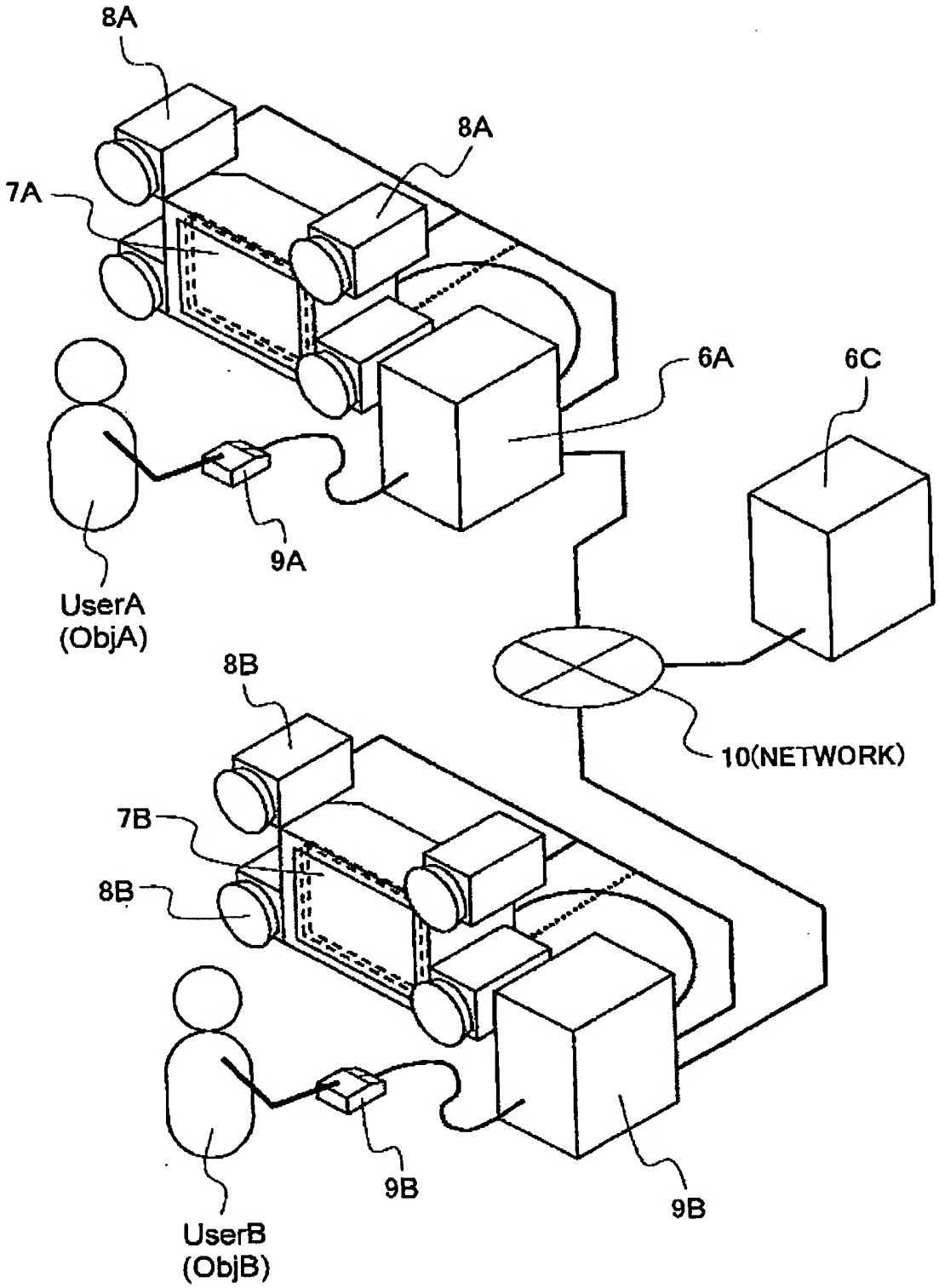

FIG.38

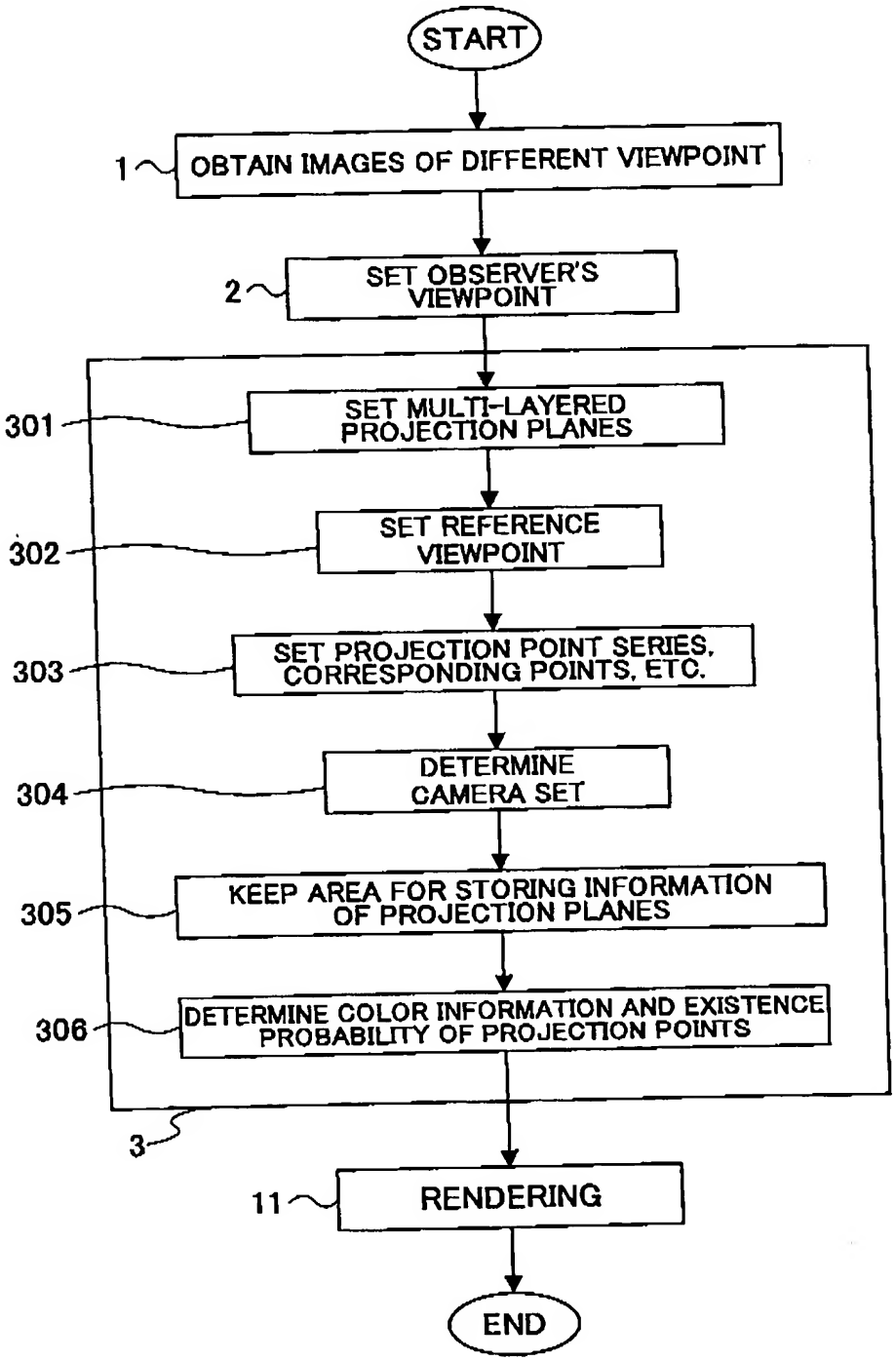
START
1
OBTAIN IMAGES OF DIFFERENT VIEWPOINT
2
SET OBSERVER'S VIEWPOINT
301
SET MULTI-LAYERED PROJECTION PLANES
302
SET REFERENCE VIEWPOINT
303
SET PROJECTION POINT SERIES, CORRESPONDING POINTS, ETC.
304
DETERMINE CAMERA SET
305
KEEP AREA FOR STORING INFORMATION OF PROJECTION PLANES
306
DETERMINE COLOR INFORMATION AND EXISTENCE PROBABILITY OF PROJECTION POINTS
3
11
RENDERING
END

FIG.39

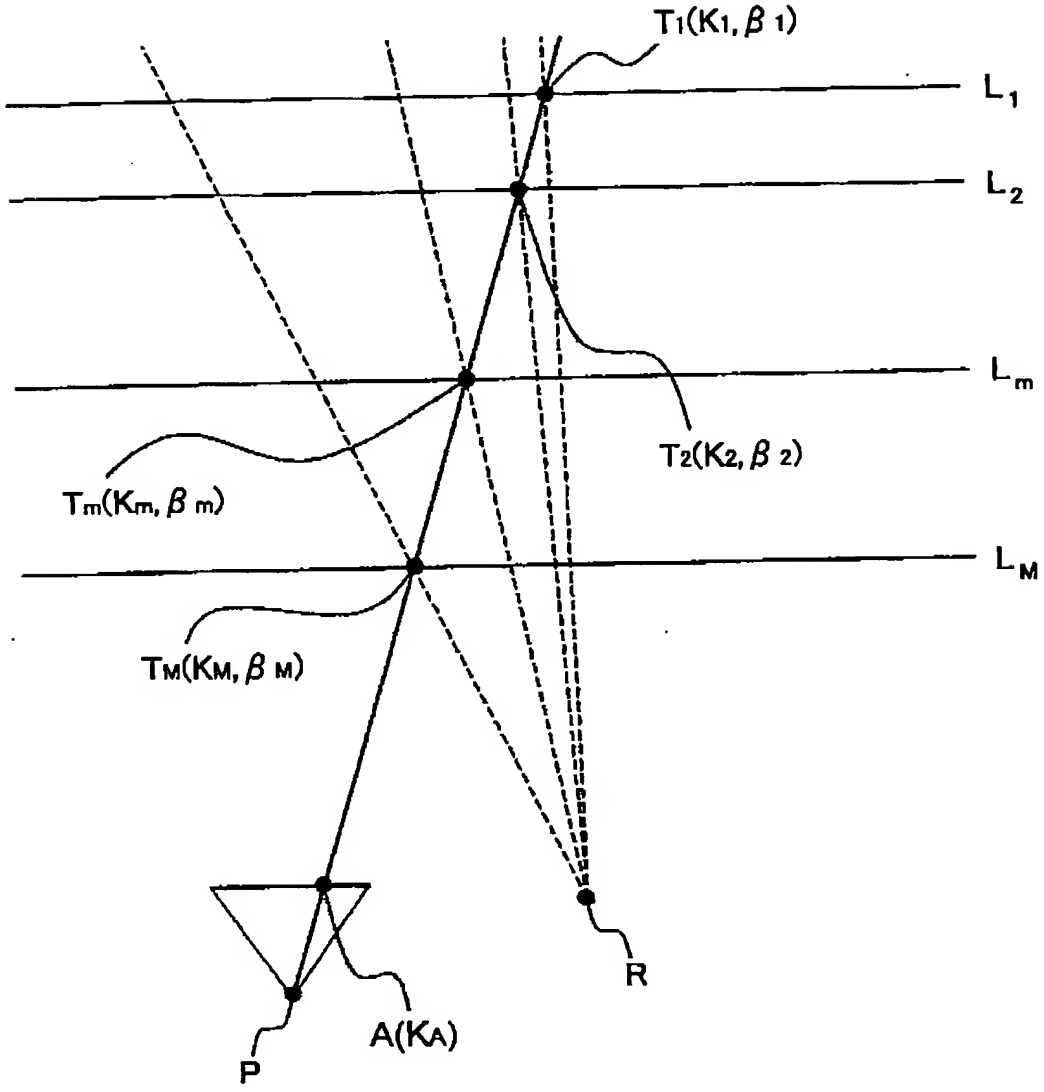

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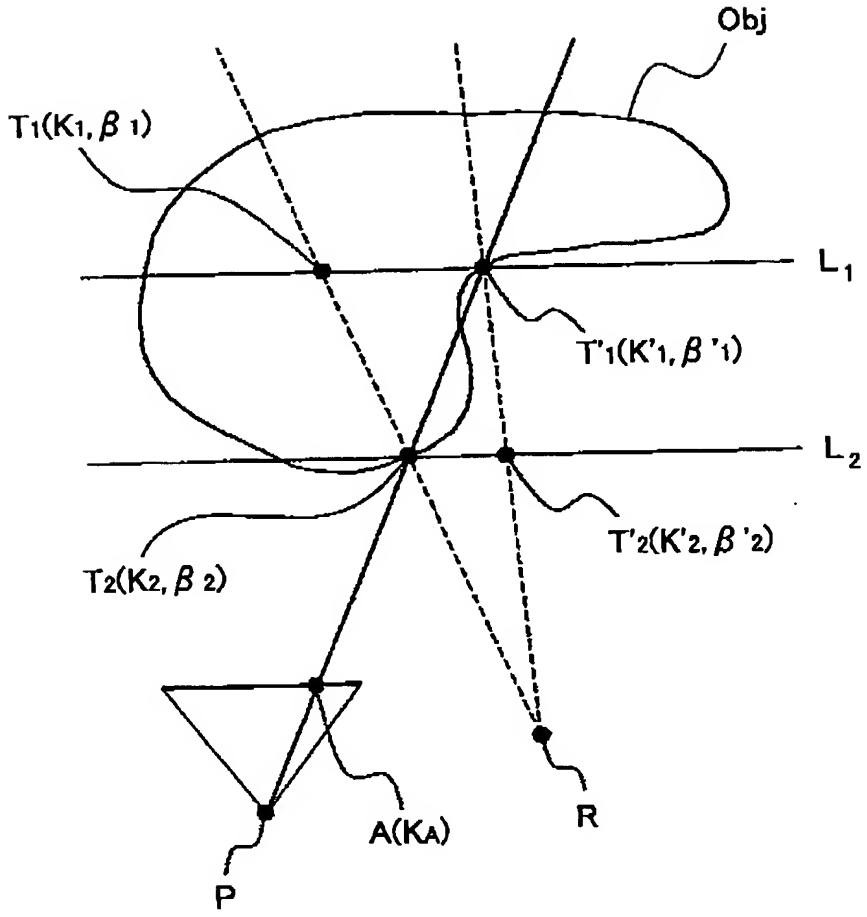
FIG.40



$\beta_1 \cong 0, \quad \beta_2 \cong 1$

$\beta'_1 \cong 1, \quad \beta'_2 \cong 0$

$K_A = \beta'_1 K'_1 + \beta_2 K_2 \fallingdotseq K'_1 + K_2$

FIG.41A

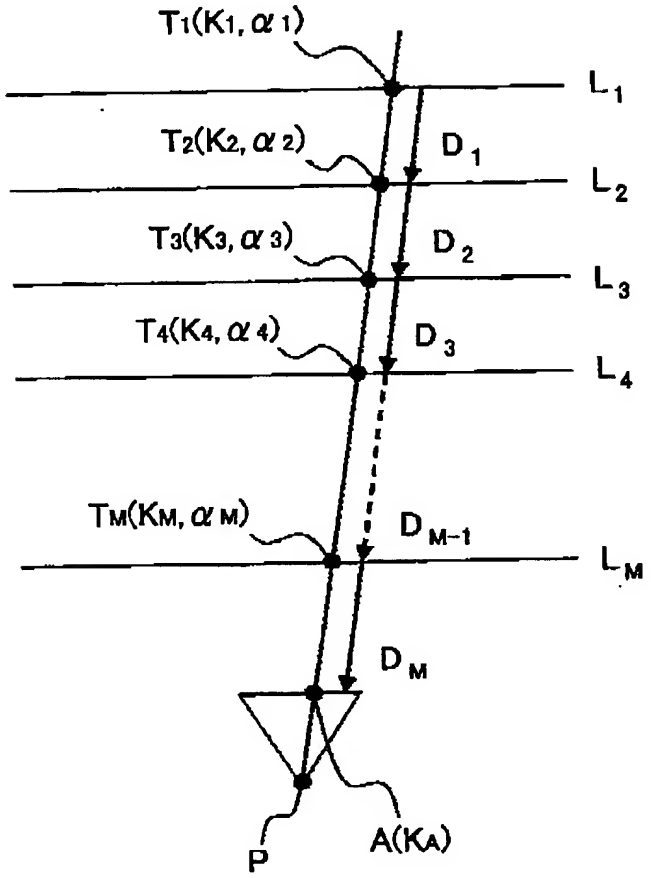


FIG.41B

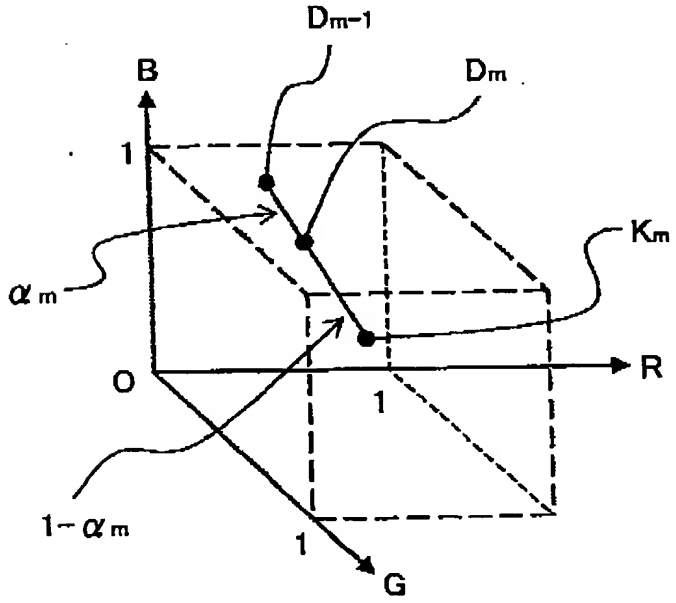


FIG.42

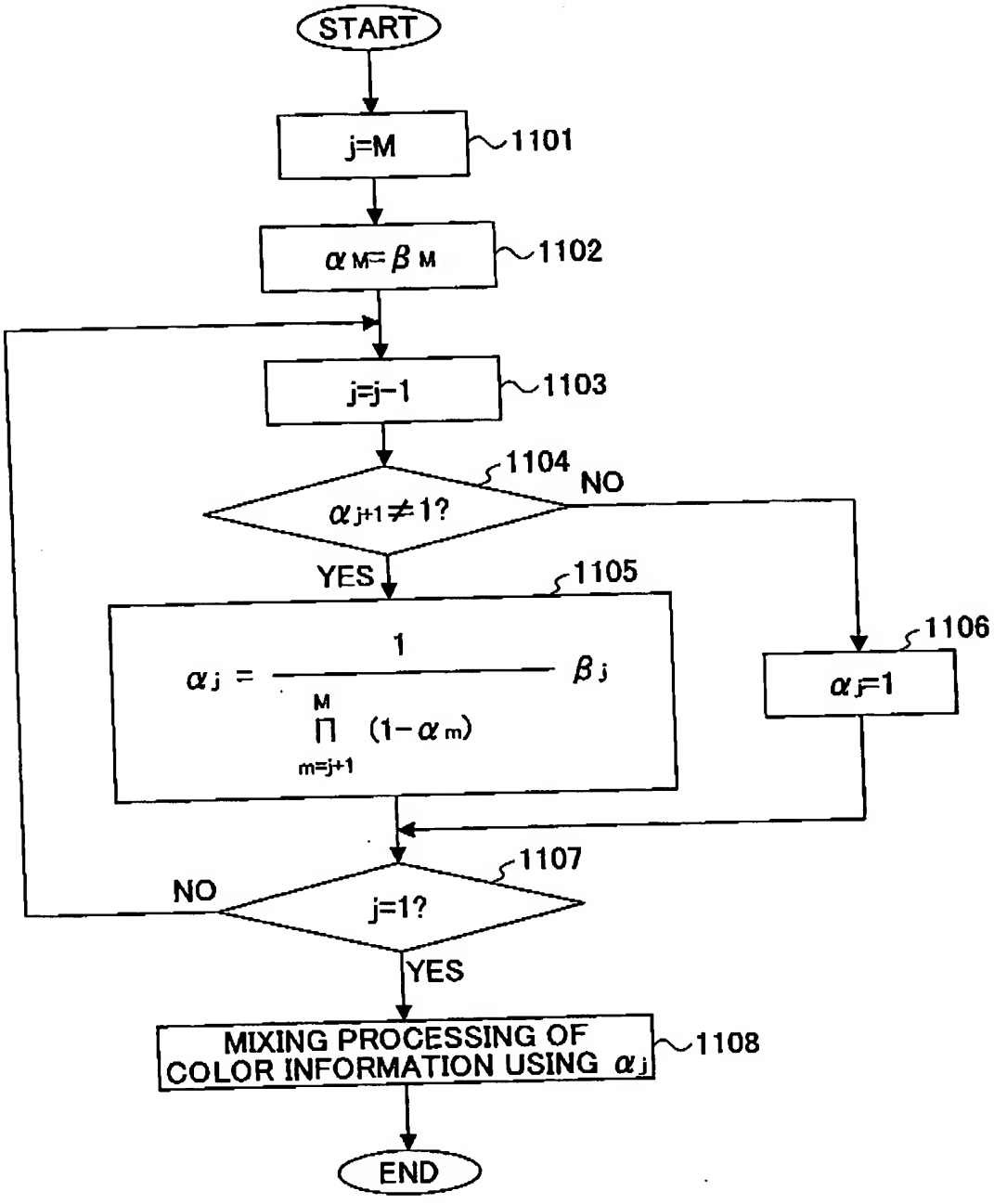

START
j=M
1101
αM=βM
1102
j=j-1
1103
1104
αj+1≠1?
NO
YES
1105
αj = 1 / ∏ (1−αm) βj
m=j+1
1106
αj=1
1107
NO
j=1?
YES
MIXING PROCESSING OF COLOR INFORMATION USING αj
1108
END

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FIG.43

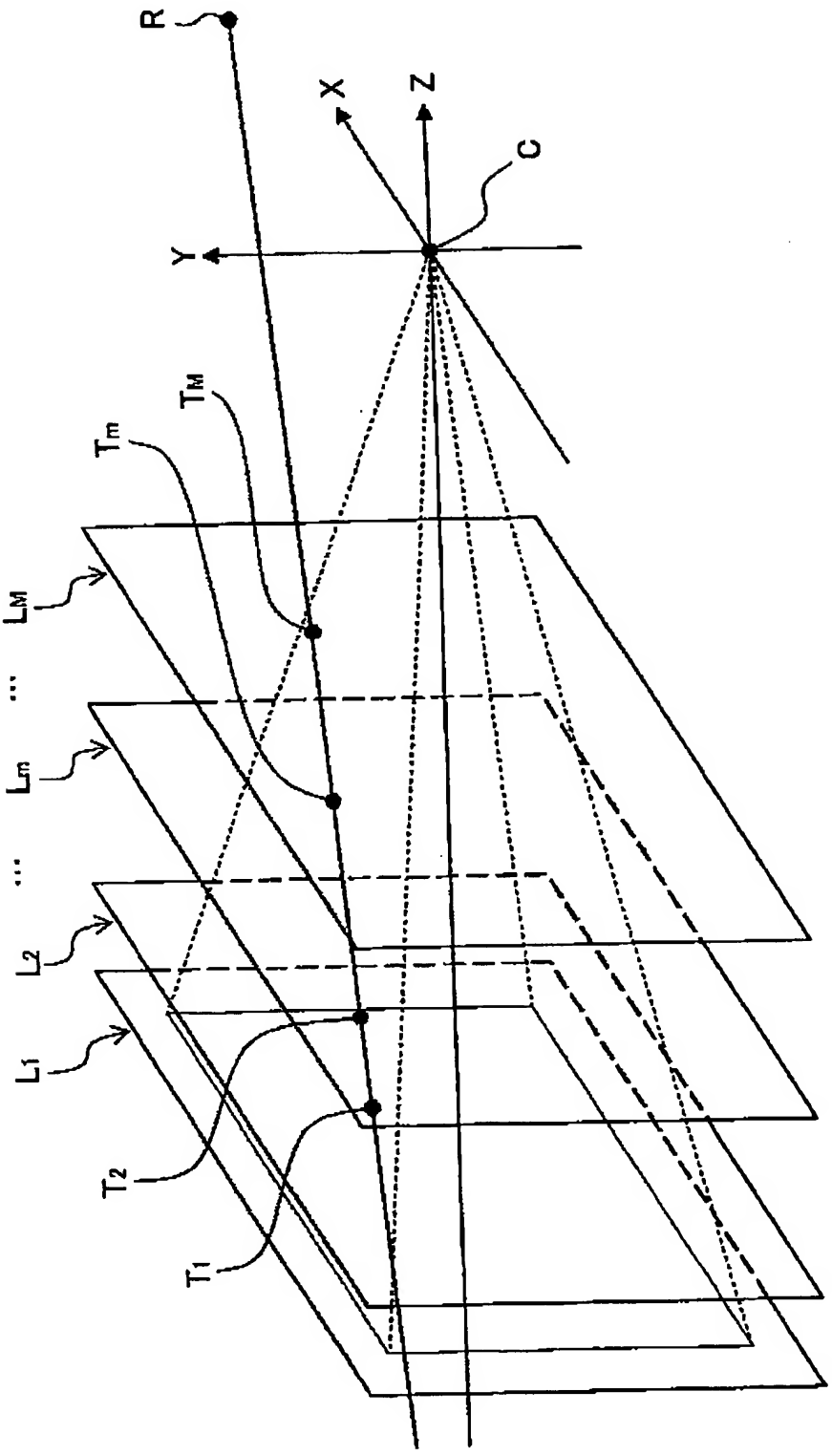

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FIG.44

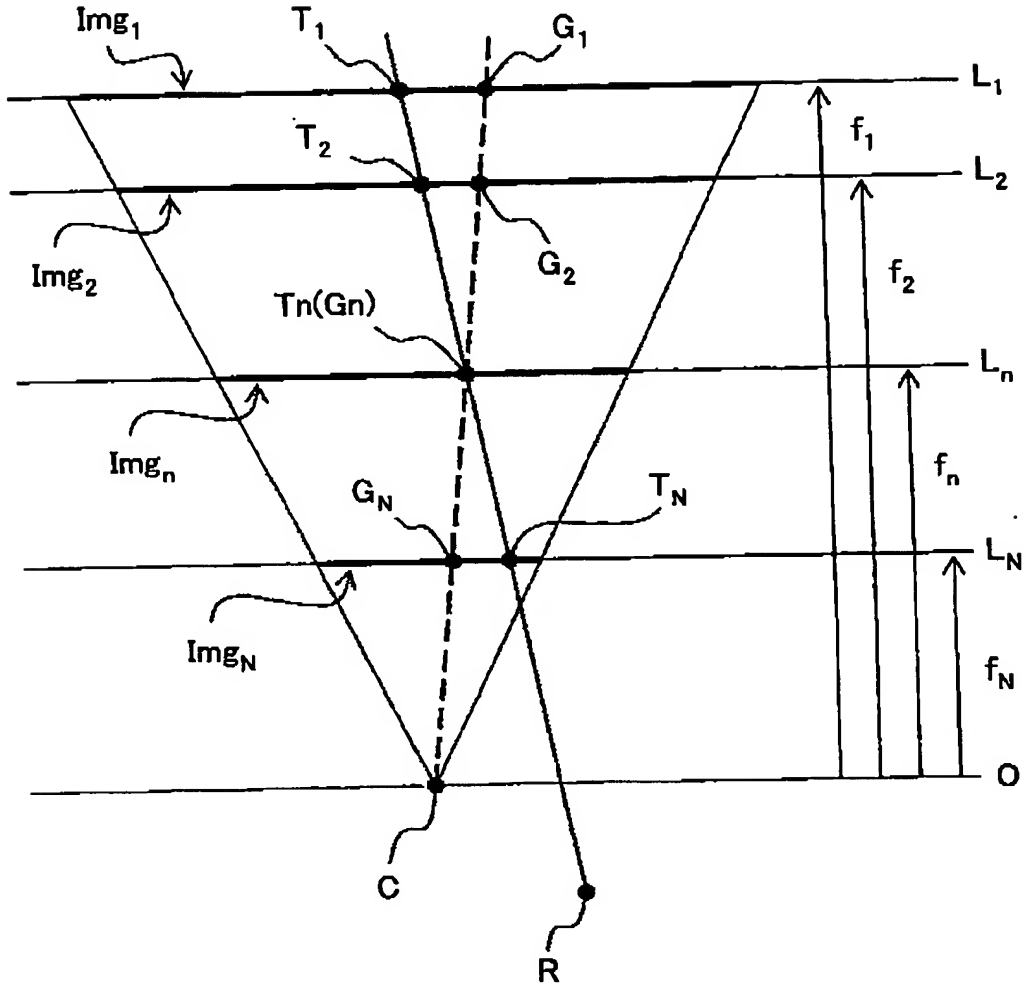

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FIG.45

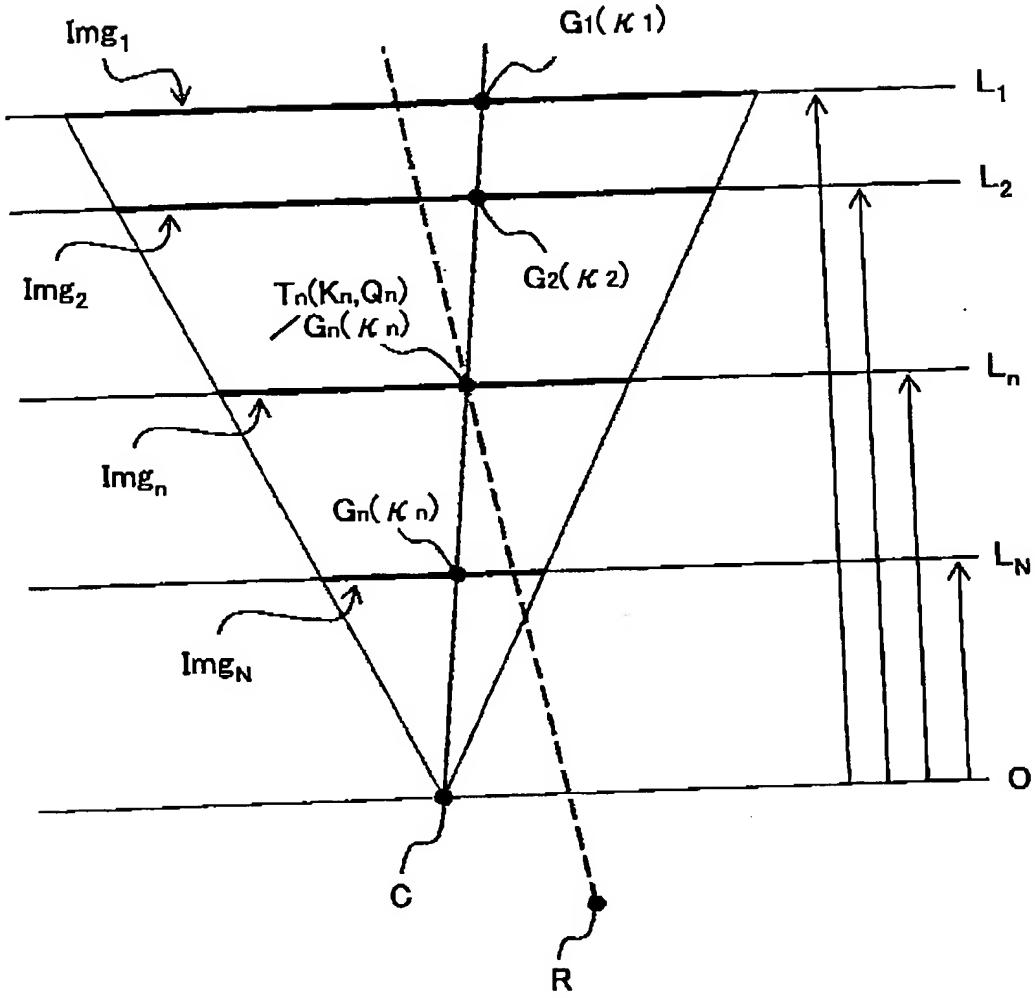

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FIG.46

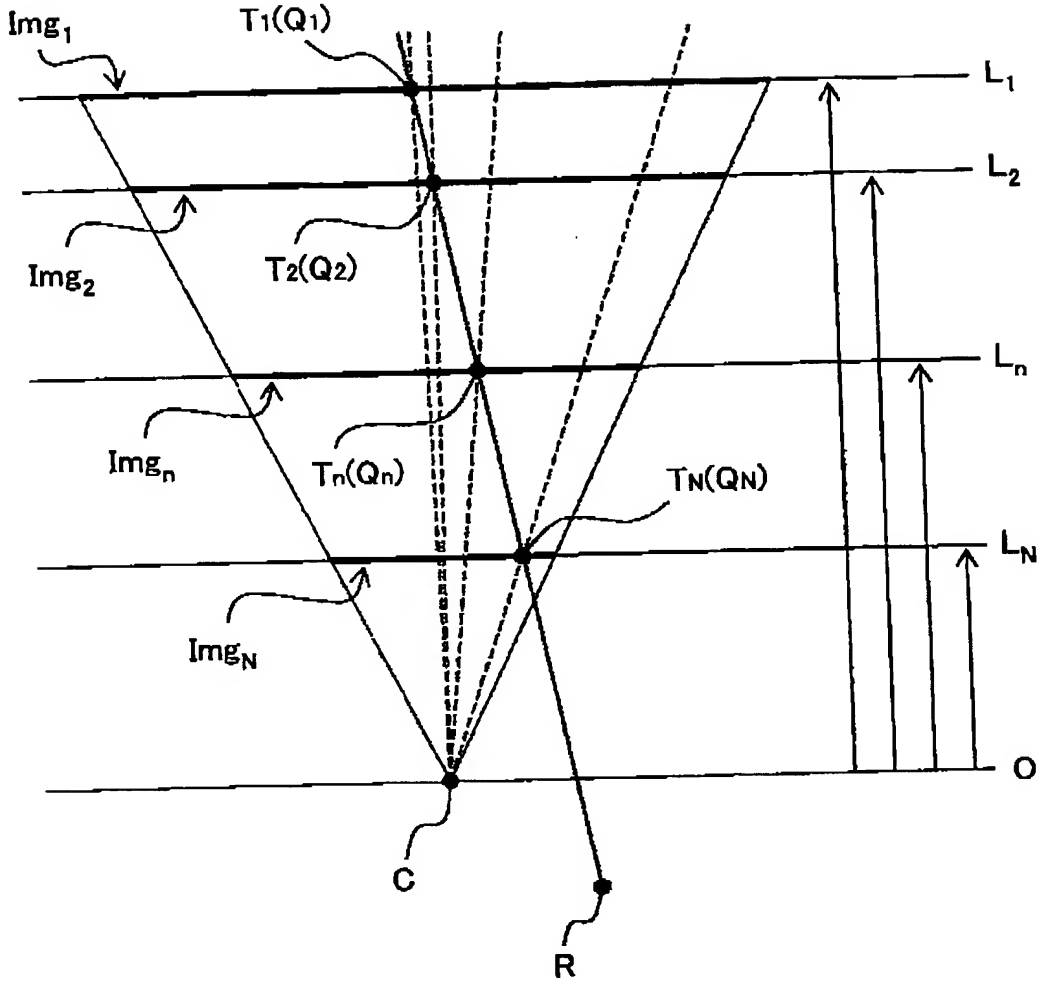

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FIG.47A

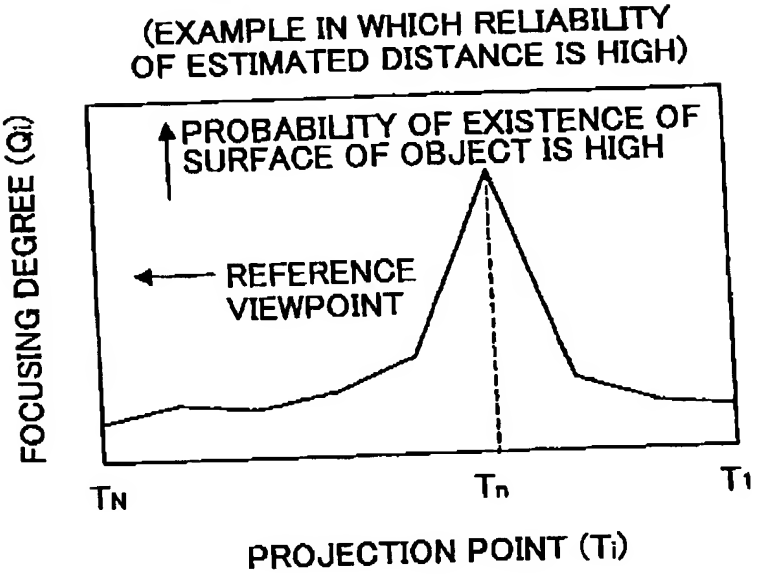

FIG.47B

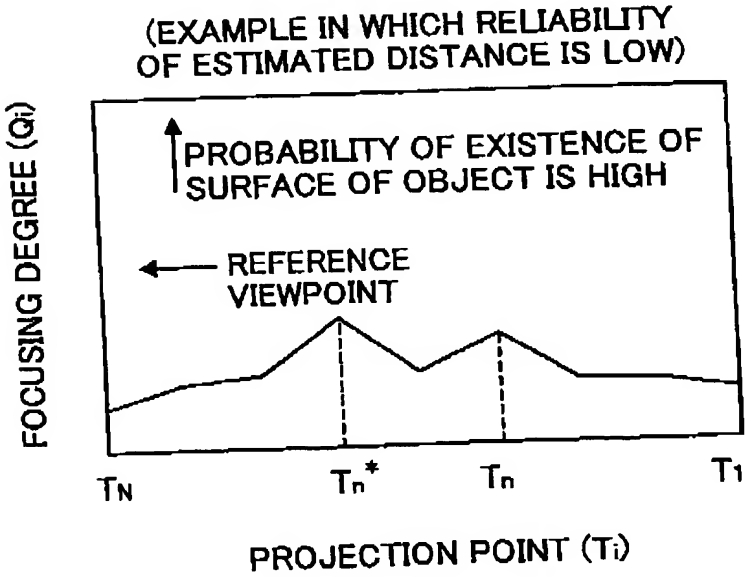

FIG.48

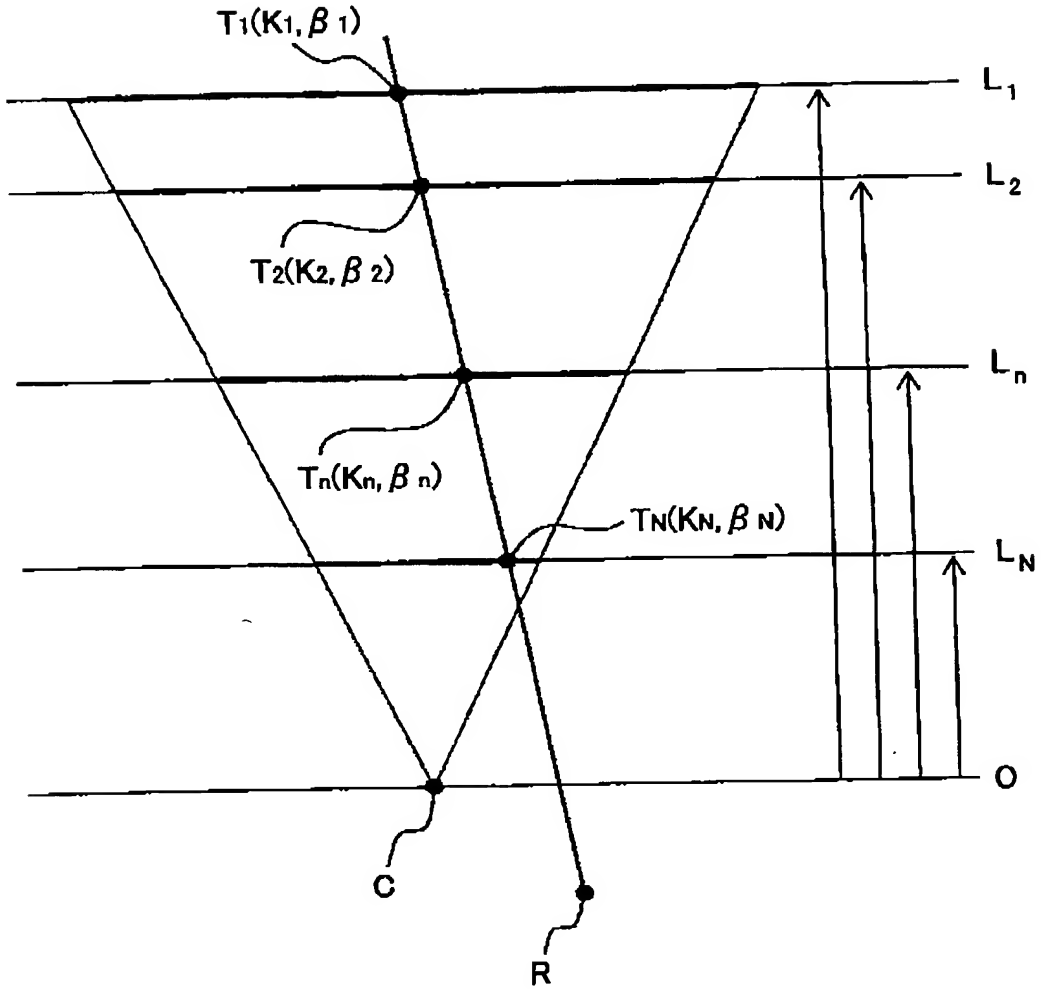

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FIG.49

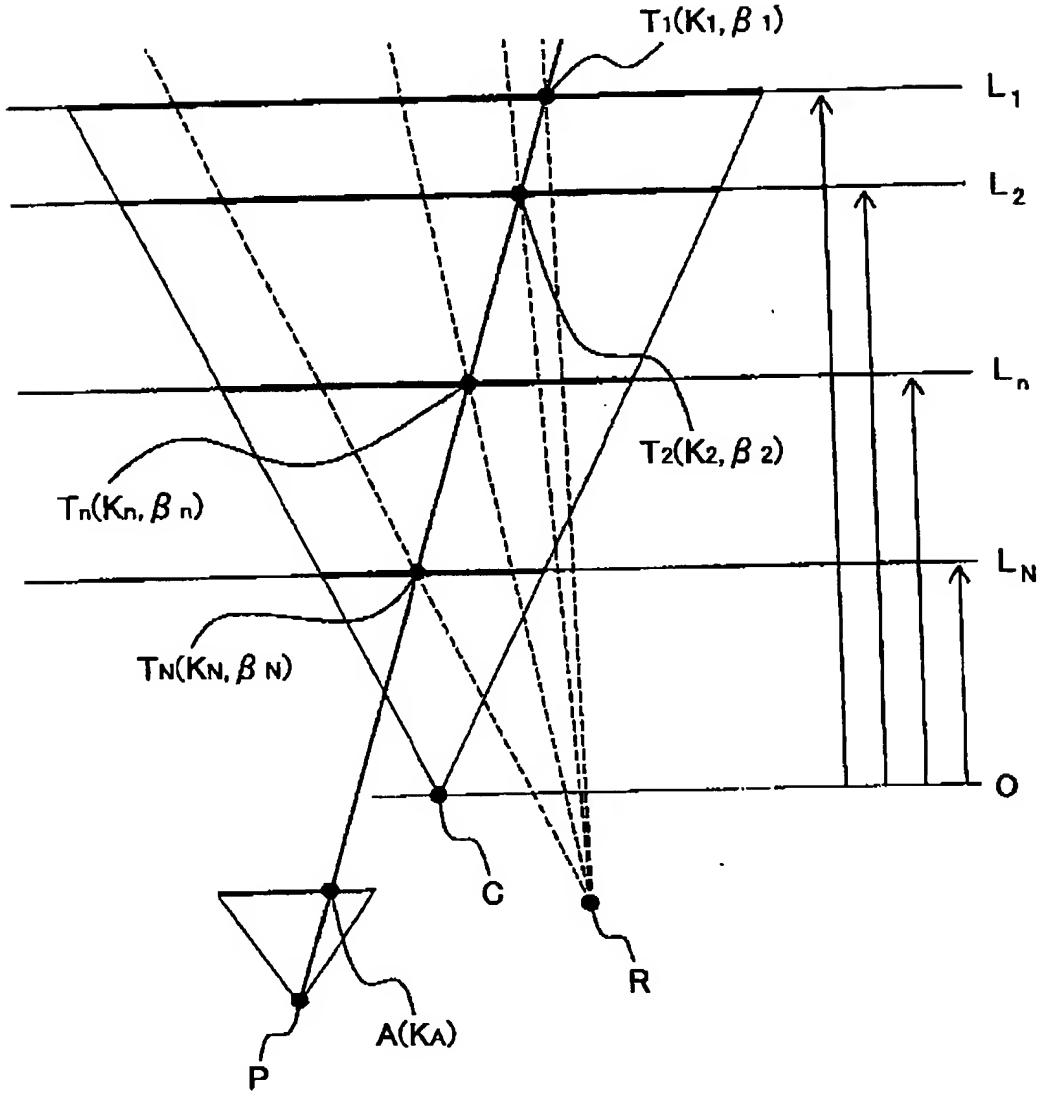

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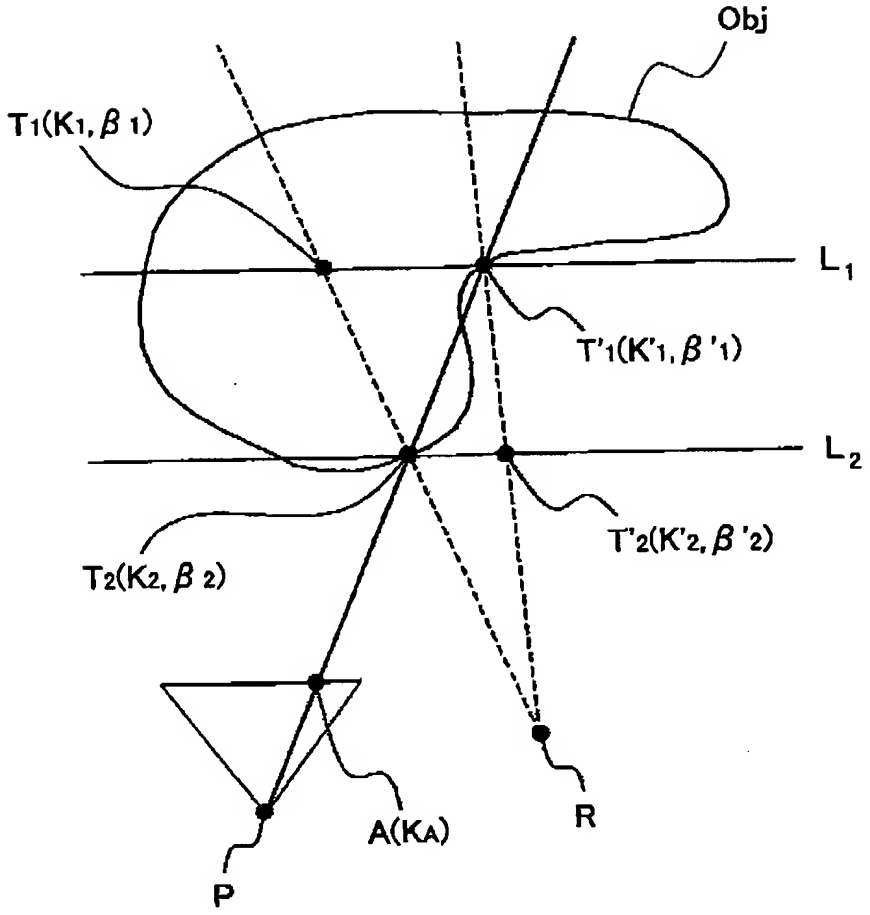
FIG.50



$\beta_1 \cong 0, \quad \beta_2 \cong 1$

$\beta'_1 \cong 1, \quad \beta'_2 \cong 0$

$K_A = \beta'_1 K'_1 + \beta_2 K_2 \fallingdotseq K'_1 + K_2$

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FIG.51A

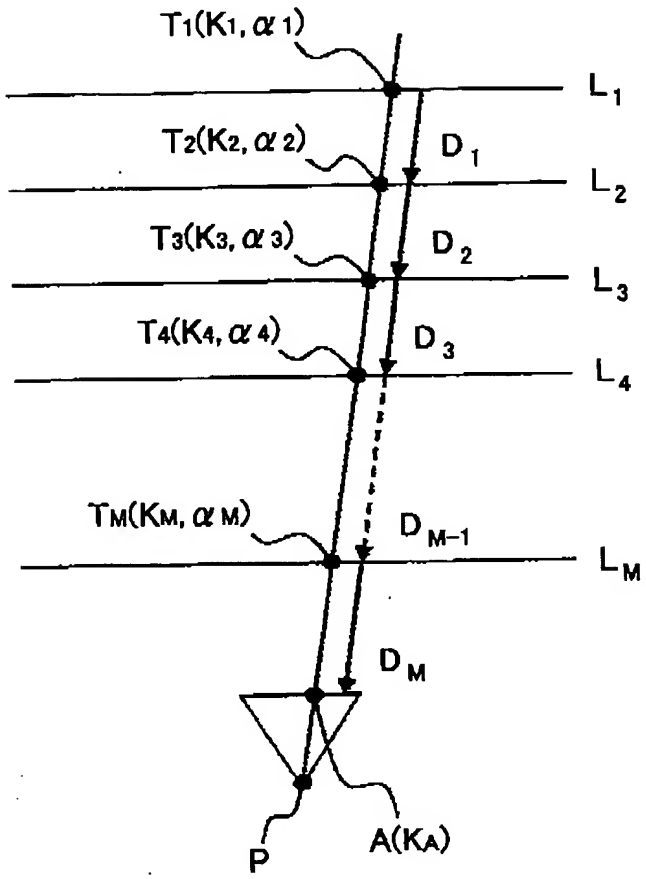

FIG.51B

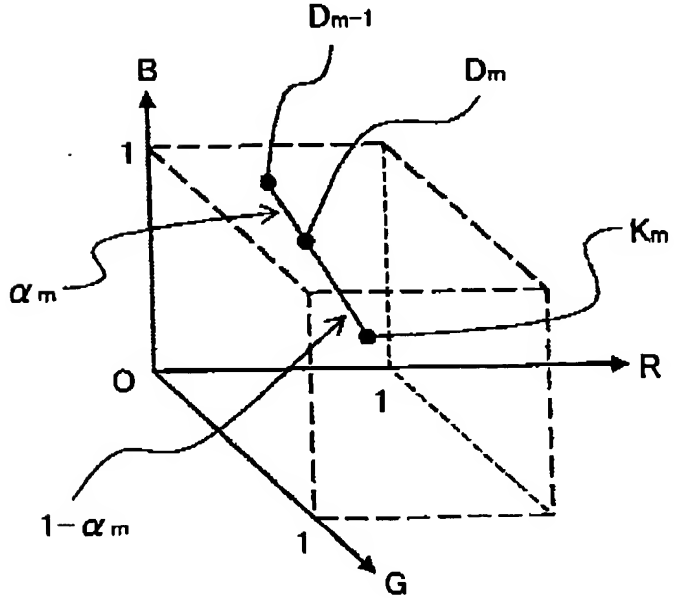

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FIG.52

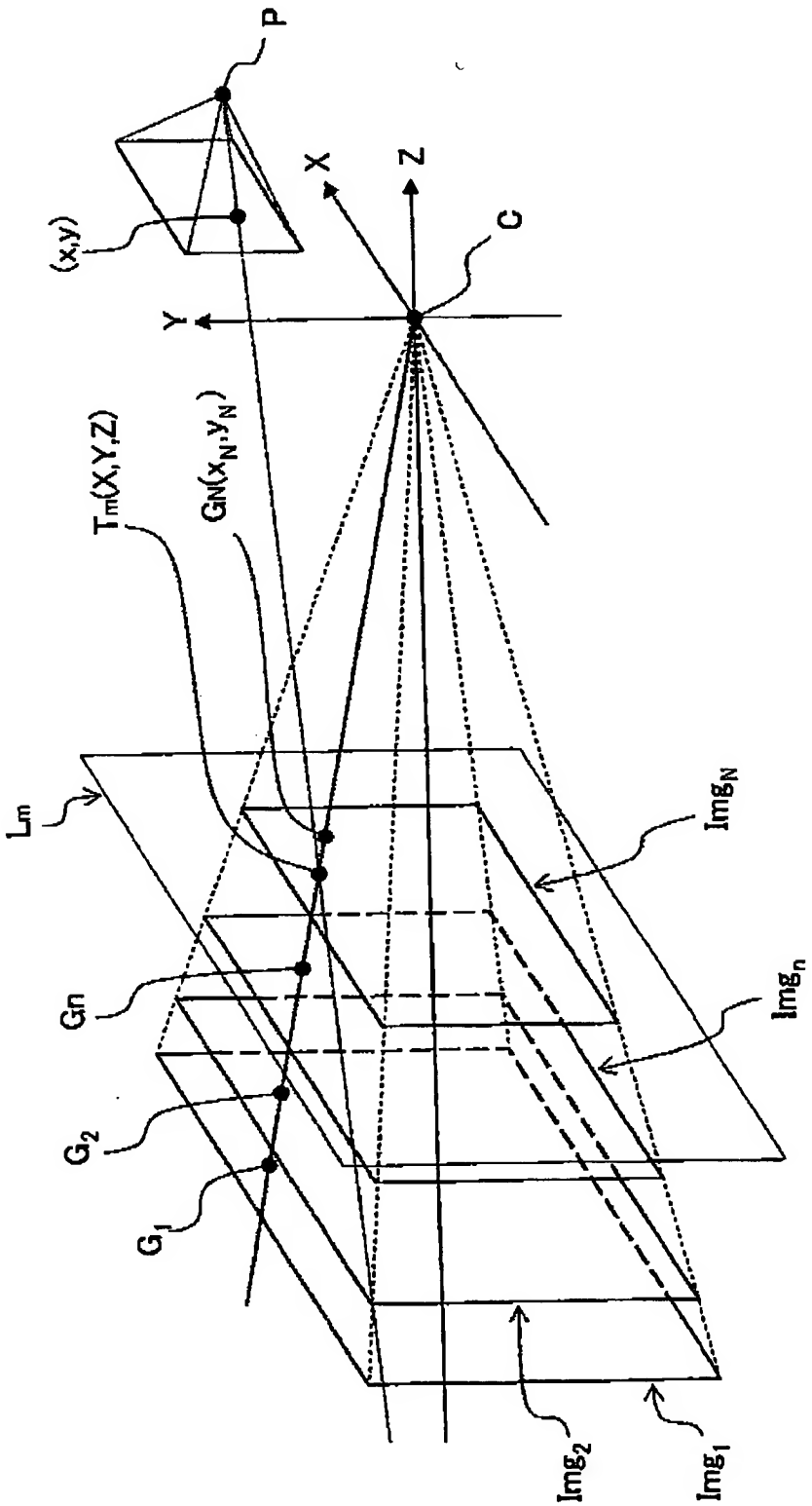

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FIG.53

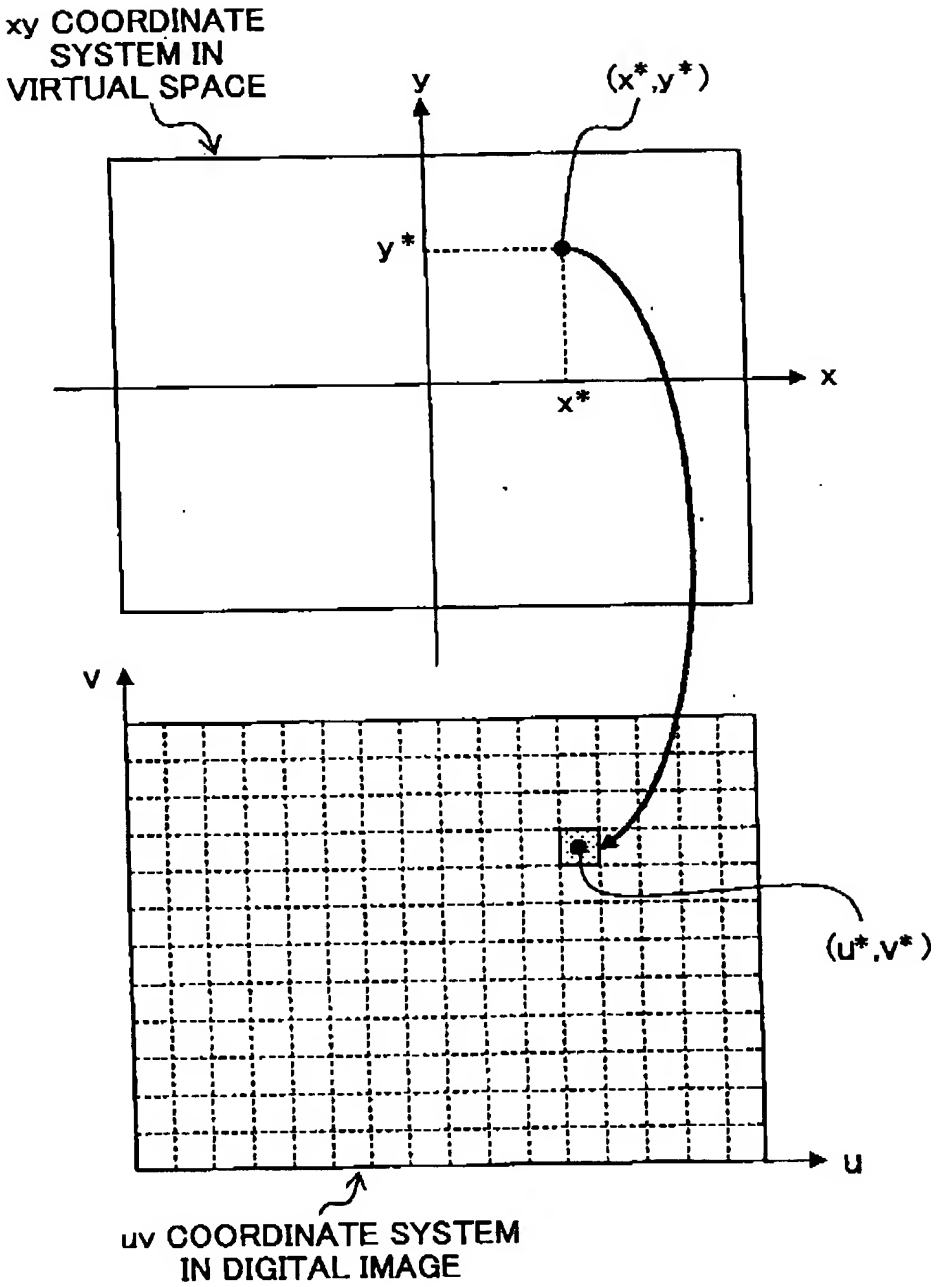

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FIG.54

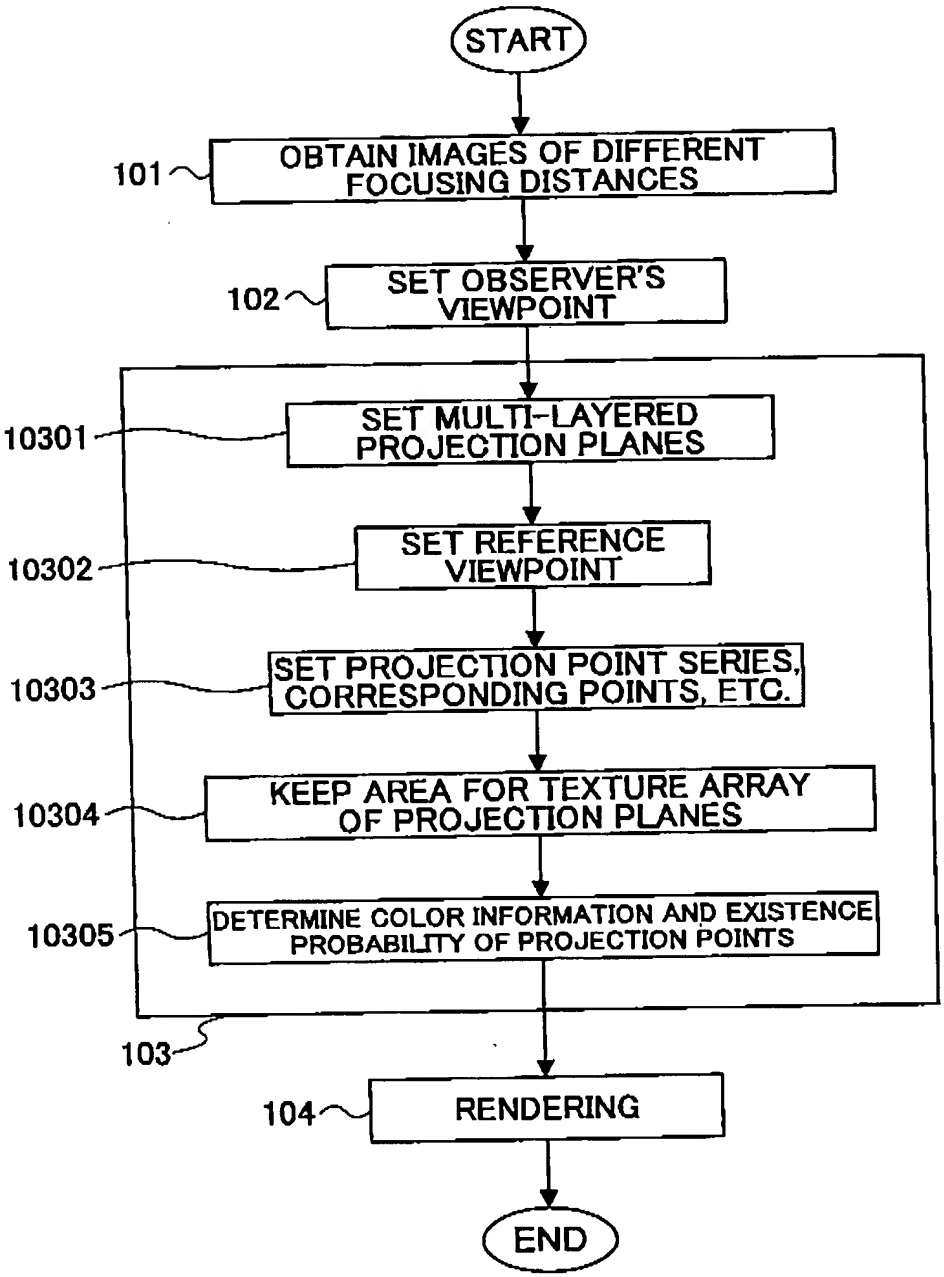

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FIG.55

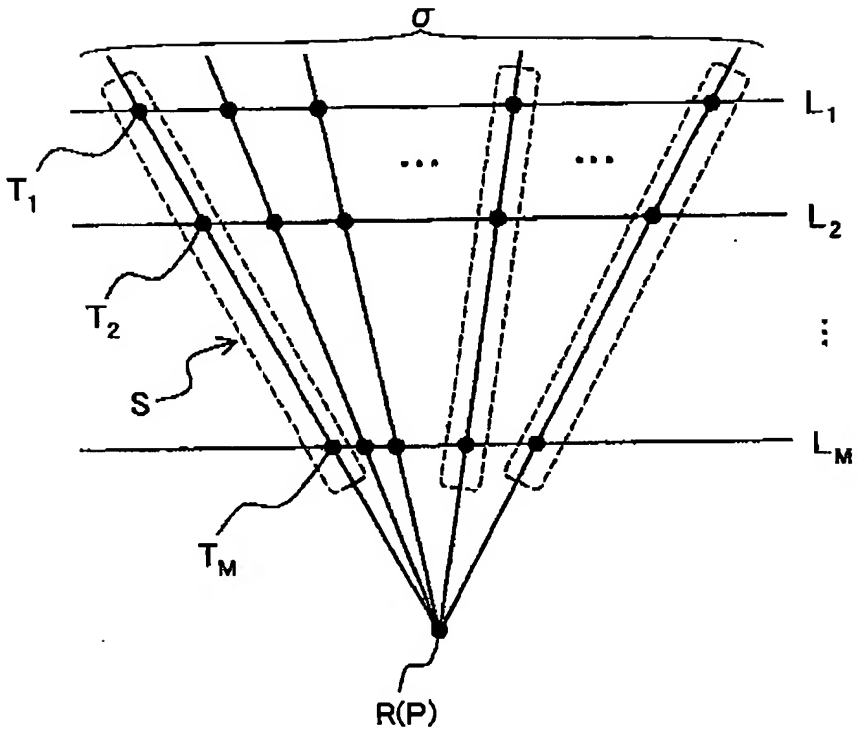

FIG.56

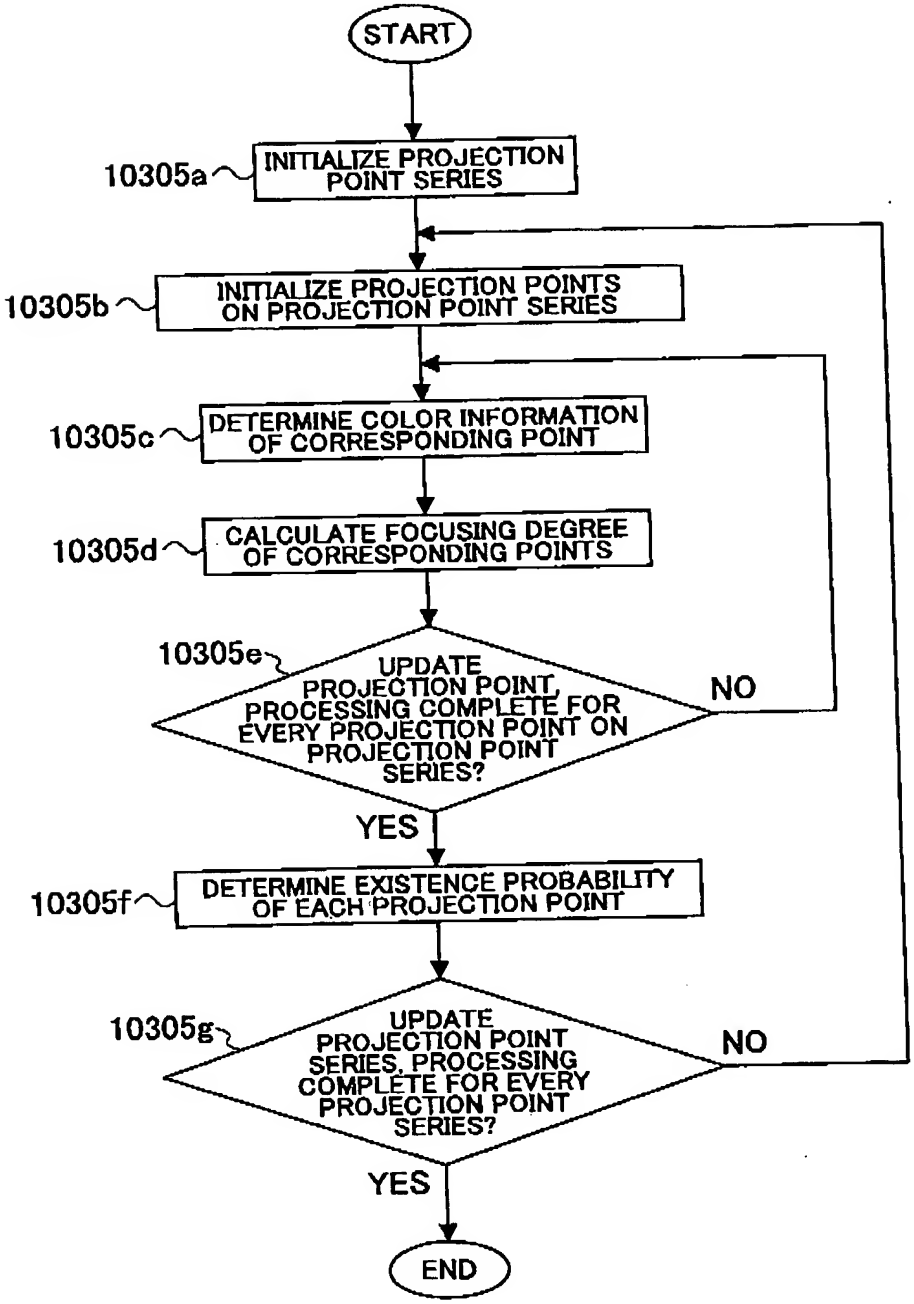
START
10305a
INITIALIZE PROJECTION POINT SERIES
10305b
INITIALIZE PROJECTION POINTS ON PROJECTION POINT SERIES
10305c
DETERMINE COLOR INFORMATION OF CORRESPONDING POINT
10305d
CALCULATE FOCUSING DEGREE OF CORRESPONDING POINTS
10305e
UPDATE PROJECTION POINT, PROCESSING COMPLETE FOR EVERY PROJECTION POINT ON PROJECTION POINT SERIES?
NO
YES
10305f
DETERMINE EXISTENCE PROBABILITY OF EACH PROJECTION POINT
10305g
UPDATE PROJECTION POINT SERIES, PROCESSING COMPLETE FOR EVERY PROJECTION POINT SERIES?
NO
YES
END

FIG.57

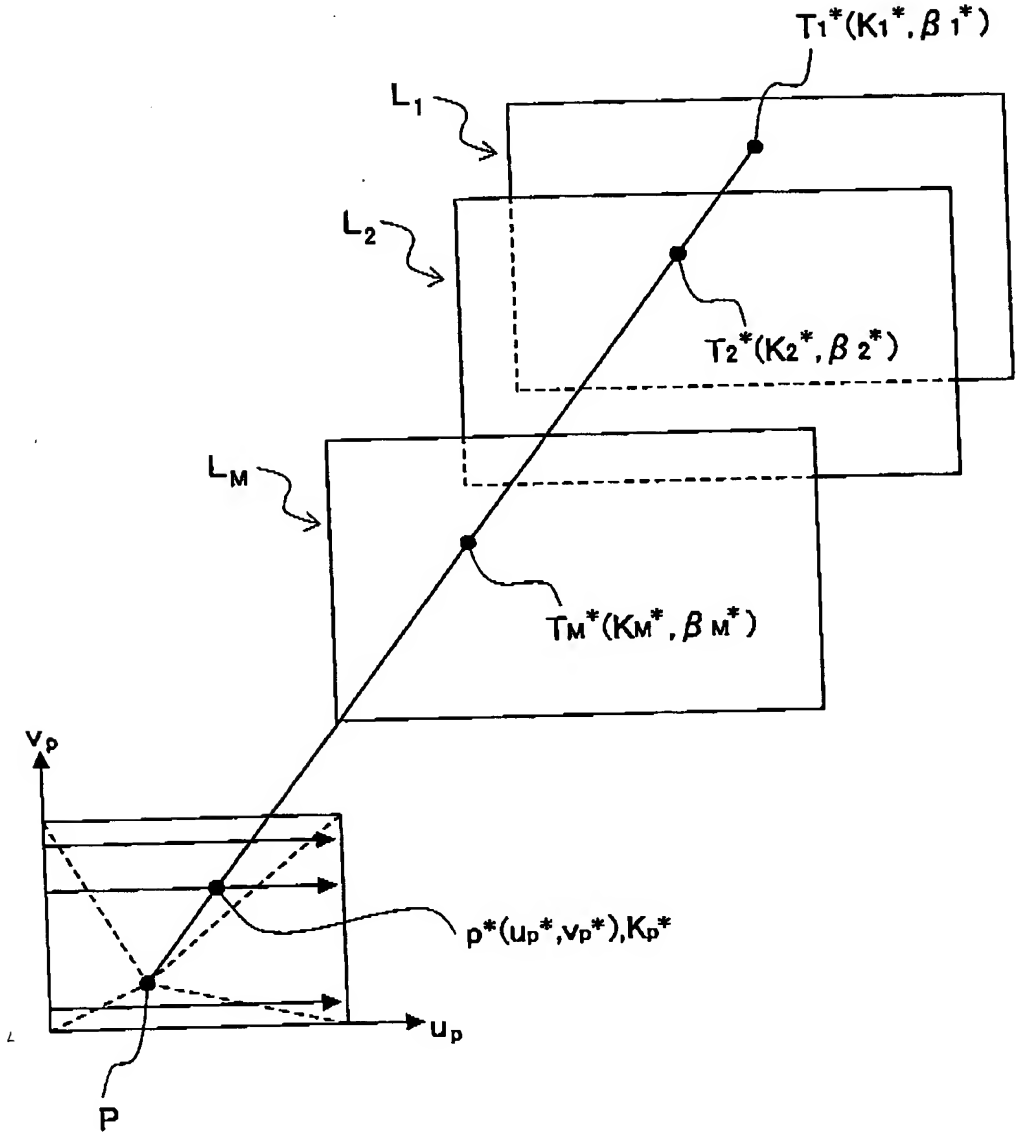

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FIG.58

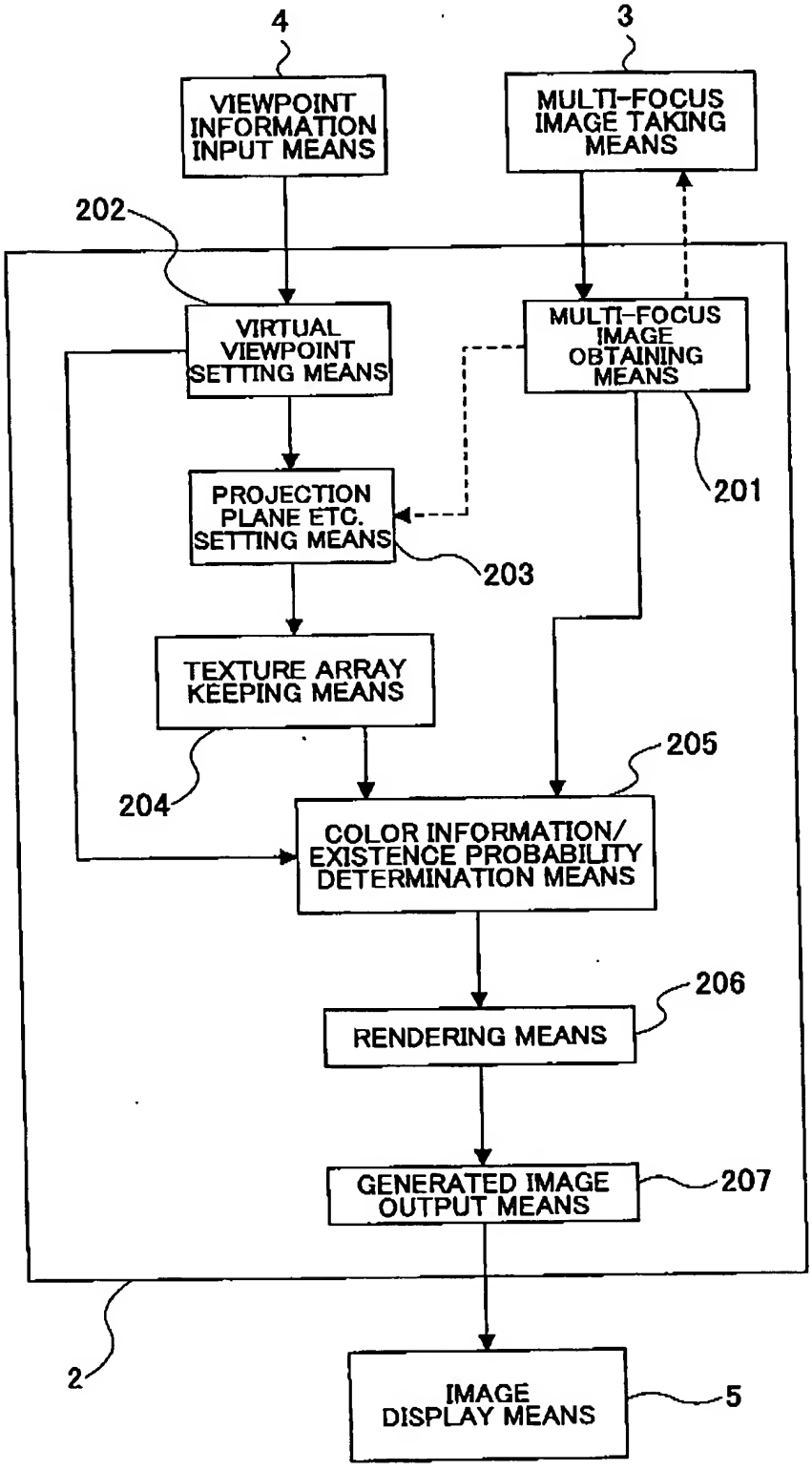

FIG.59A

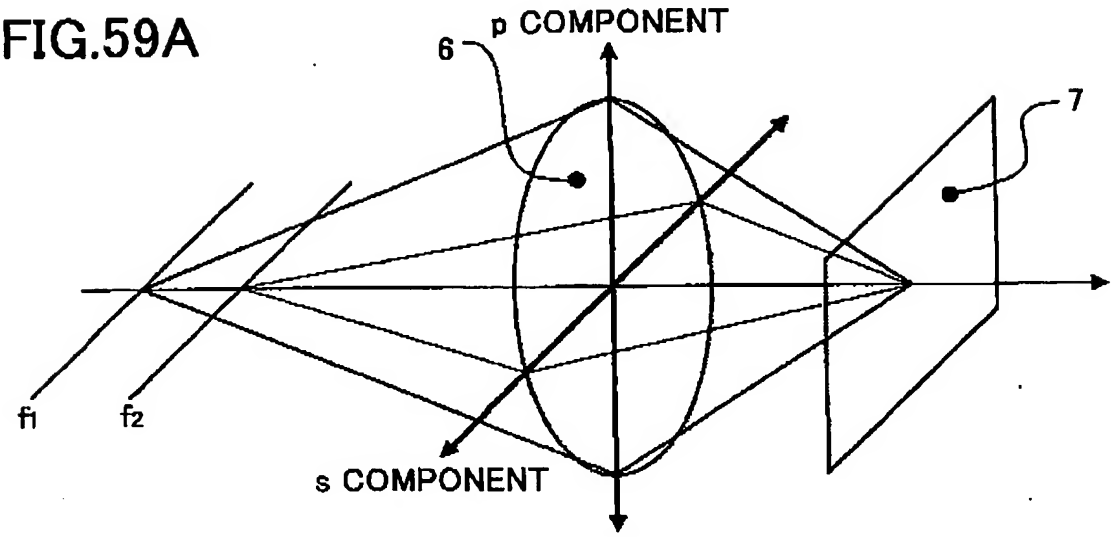

FIG.59B

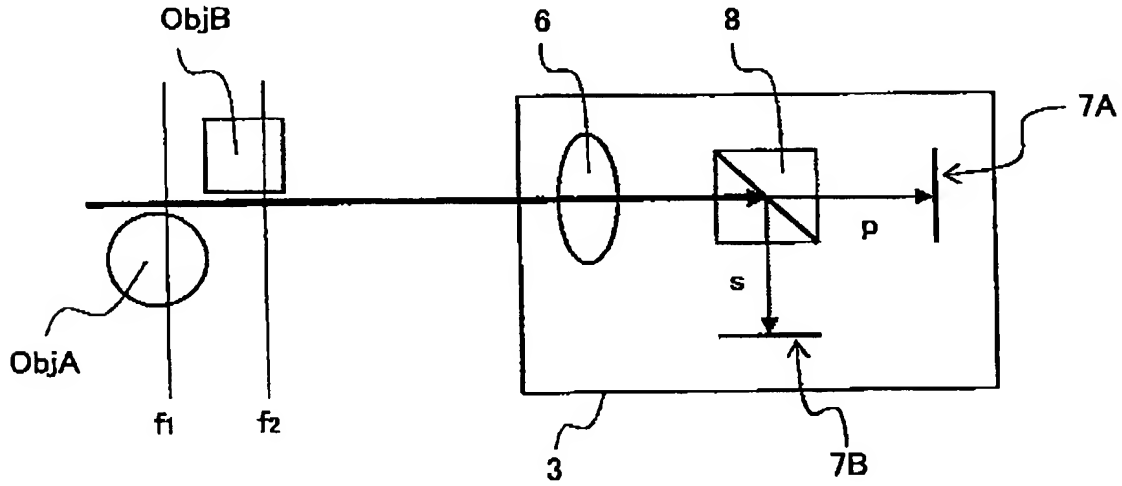

FIG.59C

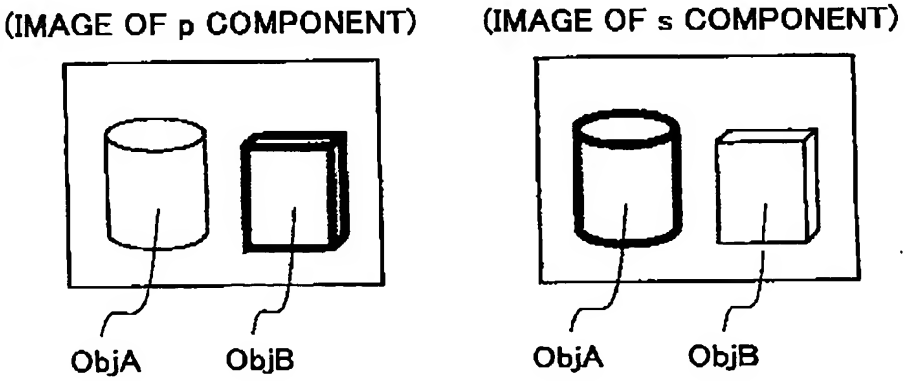

FIG.60A

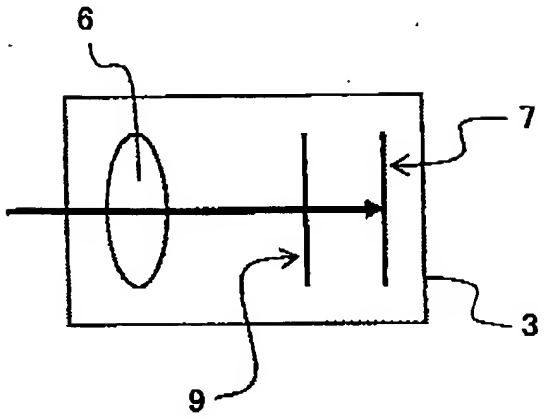

FIG.60B

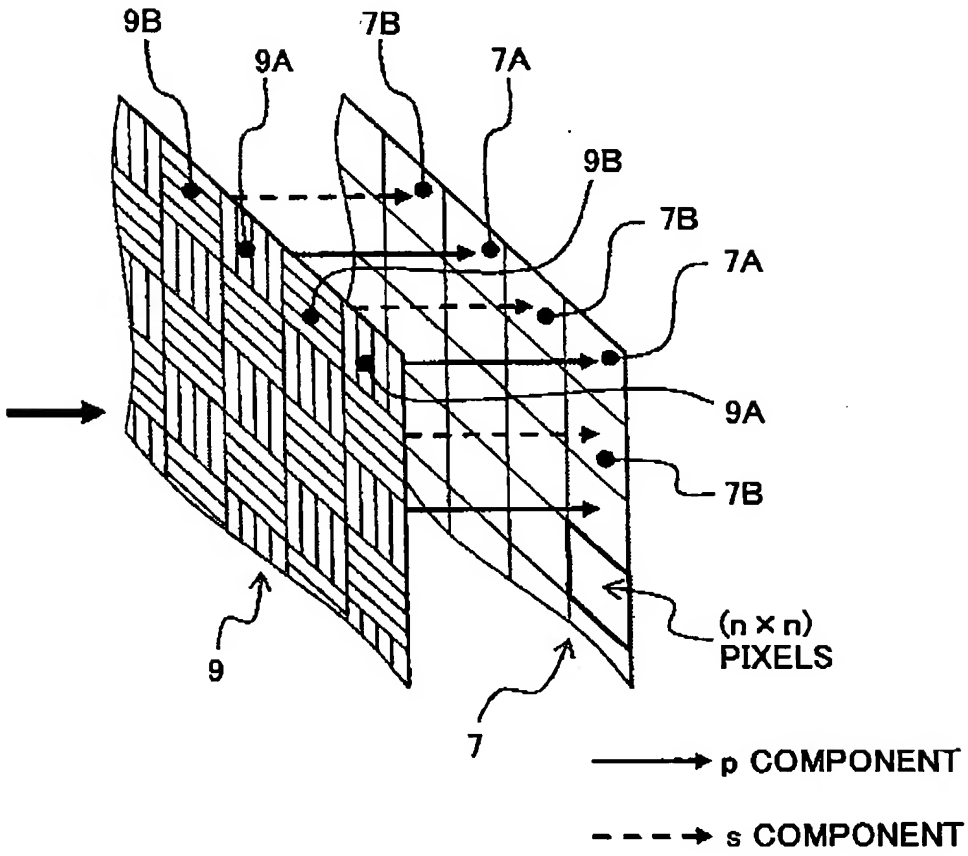

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FIG.61A

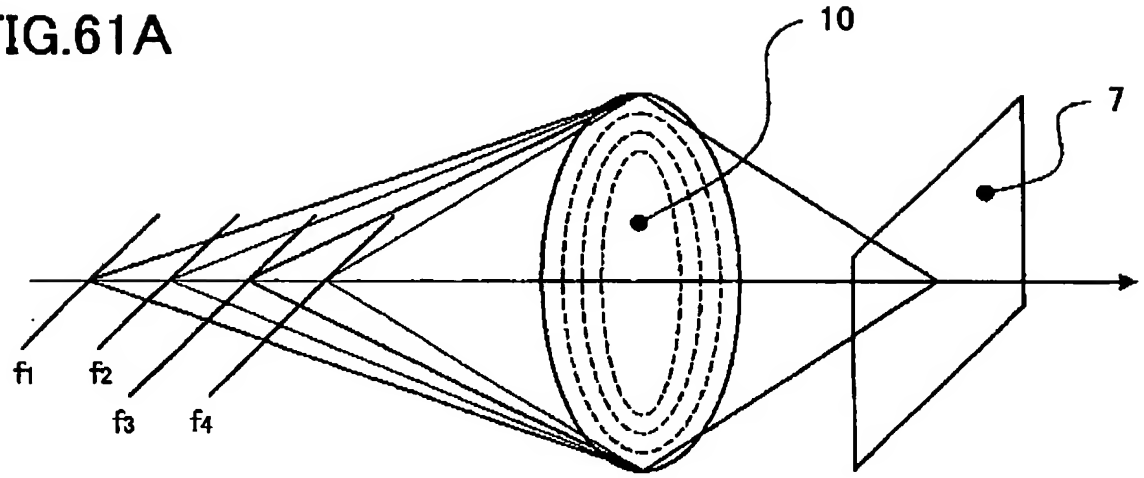

FIG.61B

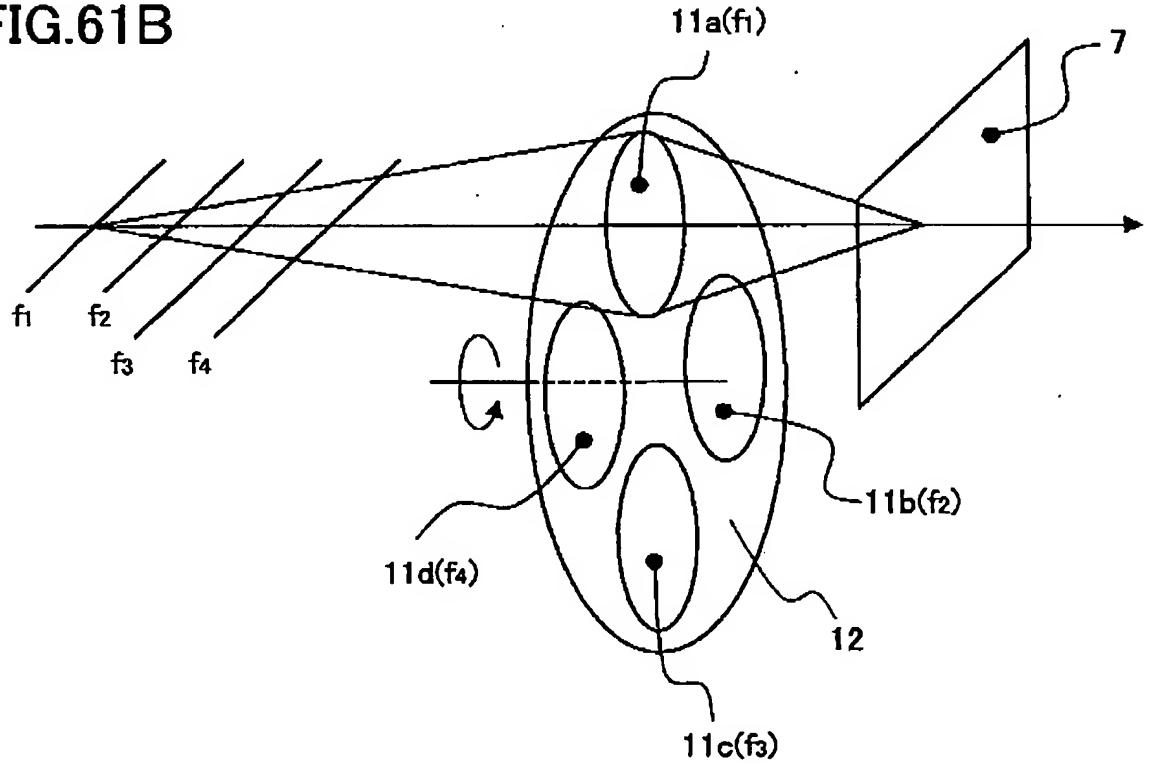

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FIG.62

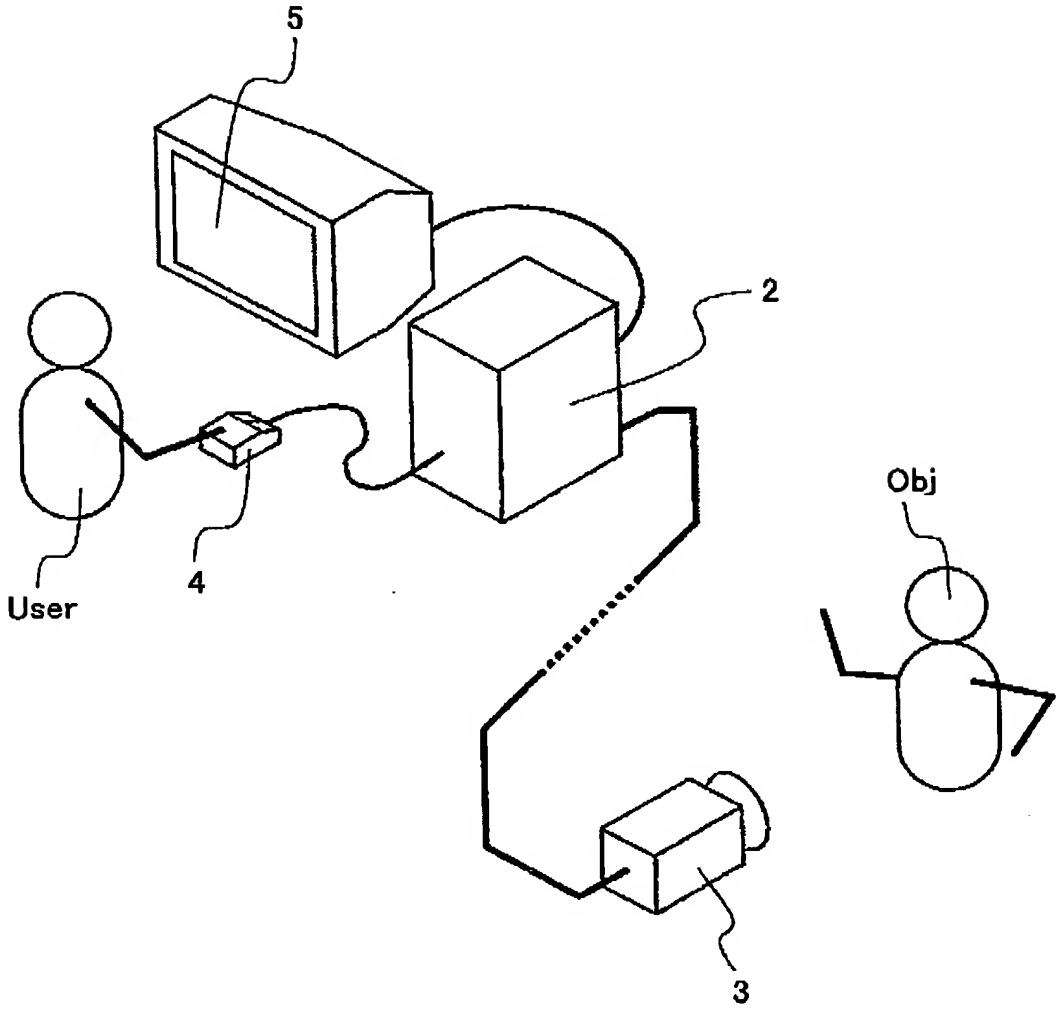

FIG.63

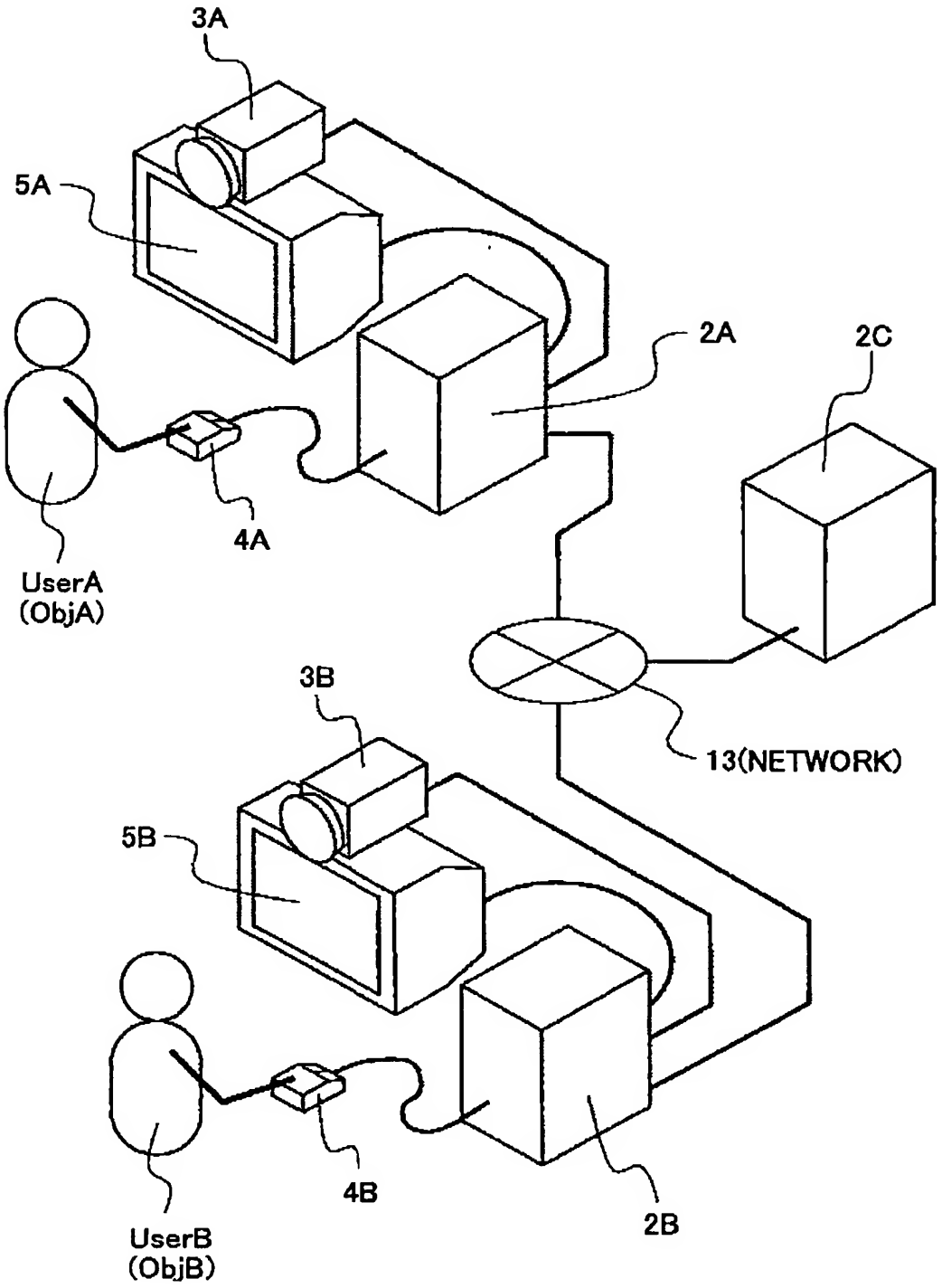

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FIG.64

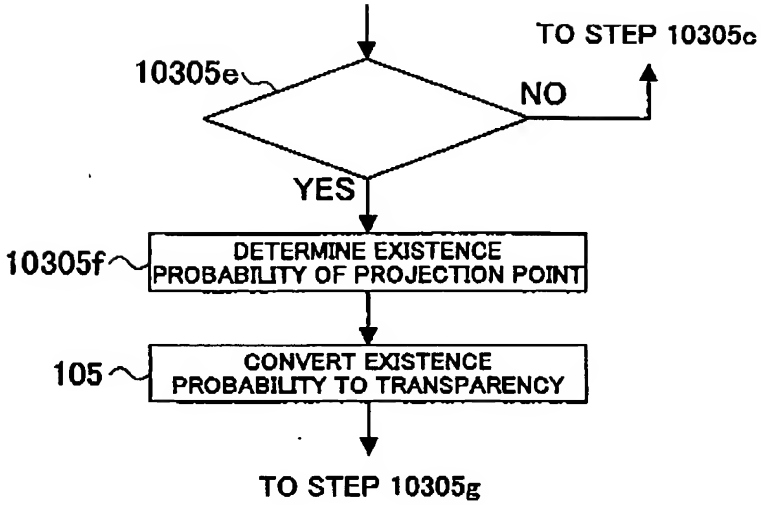

FIG.65

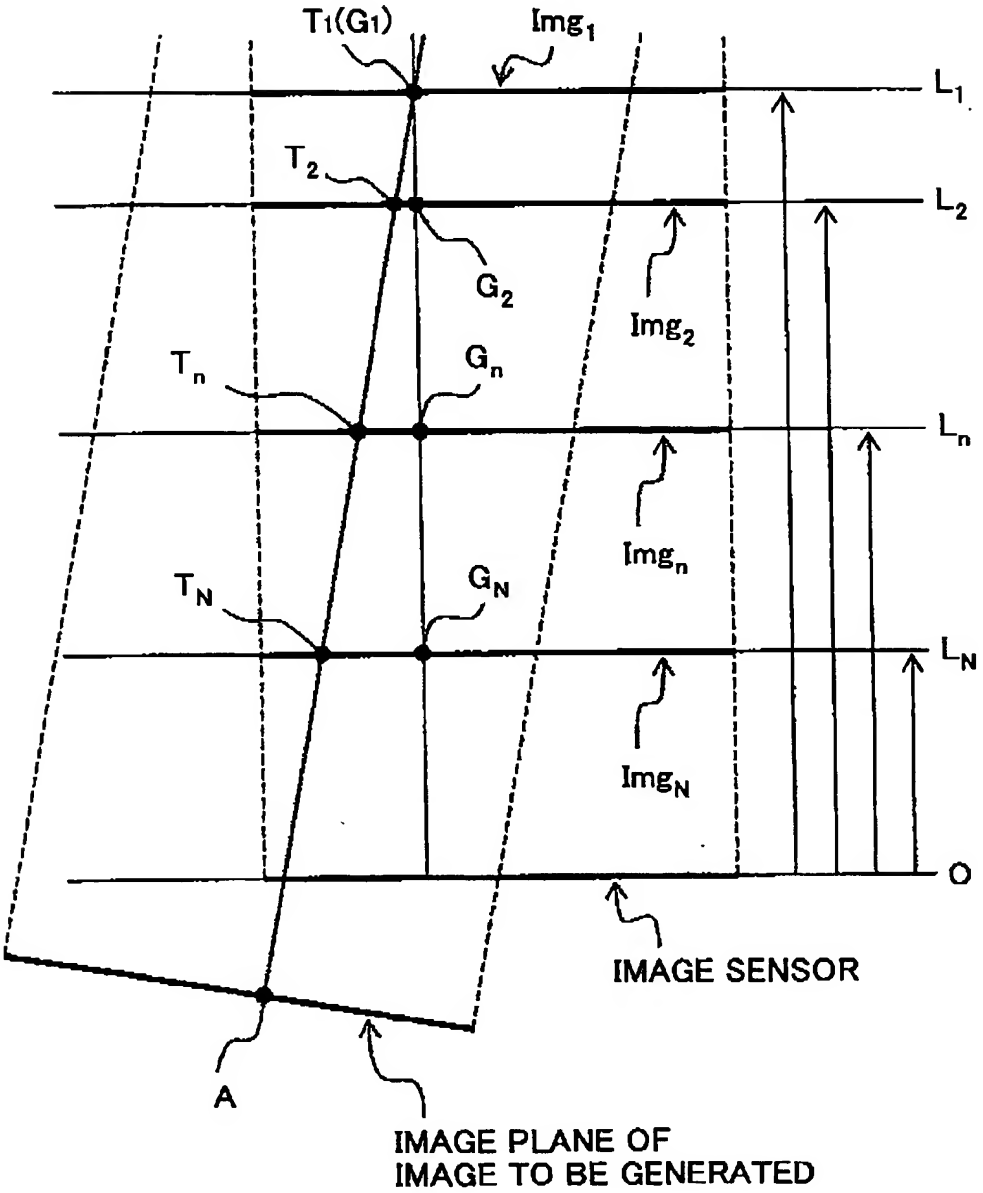
T1(G1)
Img1
L1
T2
L2
G2
Img2
Tn
Gn
Ln
Imgn
TN
GN
LN
ImgN
O
IMAGE SENSOR
A
IMAGE PLANE OF
IMAGE TO BE GENERATED

FIG.66

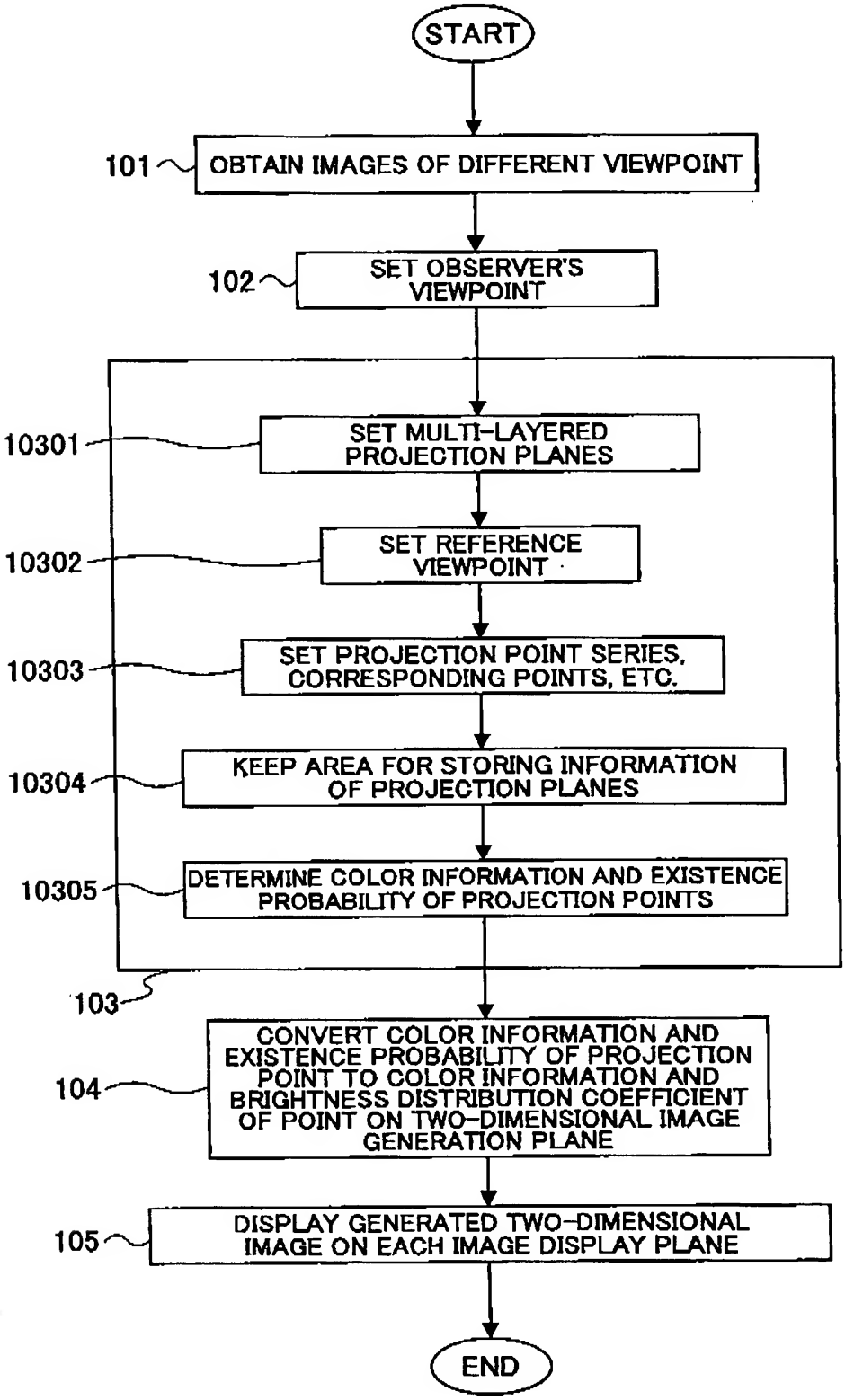
START
101
OBTAIN IMAGES OF DIFFERENT VIEWPOINT
102
SET OBSERVER'S VIEWPOINT
10301
SET MULTI-LAYERED PROJECTION PLANES
10302
SET REFERENCE VIEWPOINT
10303
SET PROJECTION POINT SERIES, CORRESPONDING POINTS, ETC.
10304
KEEP AREA FOR STORING INFORMATION OF PROJECTION PLANES
10305
DETERMINE COLOR INFORMATION AND EXISTENCE PROBABILITY OF PROJECTION POINTS
103
104
CONVERT COLOR INFORMATION AND EXISTENCE PROBABILITY OF PROJECTION POINT TO COLOR INFORMATION AND BRIGHTNESS DISTRIBUTION COEFFICIENT OF POINT ON TWO-DIMENSIONAL IMAGE GENERATION PLANE
105
DISPLAY GENERATED TWO-DIMENSIONAL IMAGE ON EACH IMAGE DISPLAY PLANE
END

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FIG.67

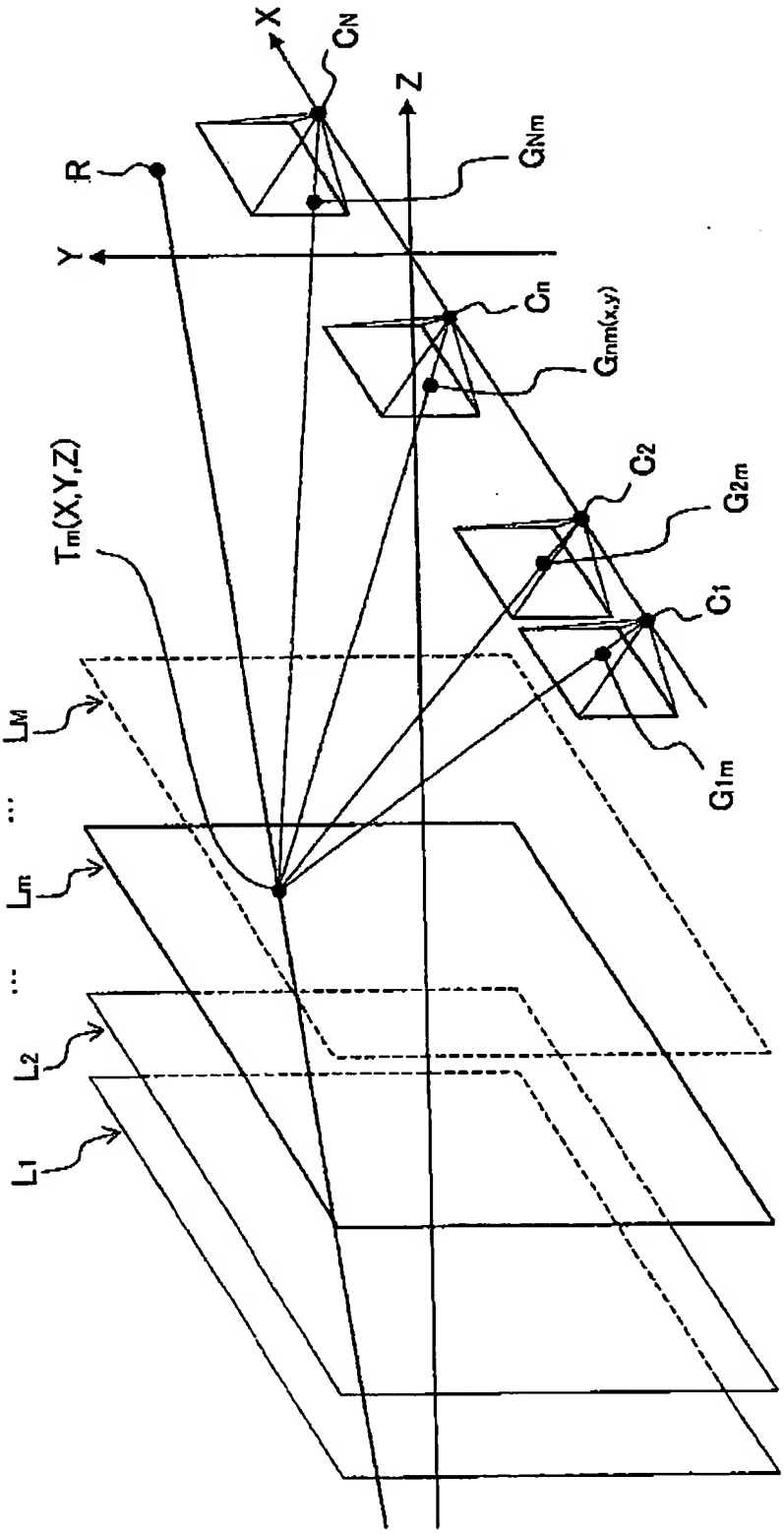

FIG.68

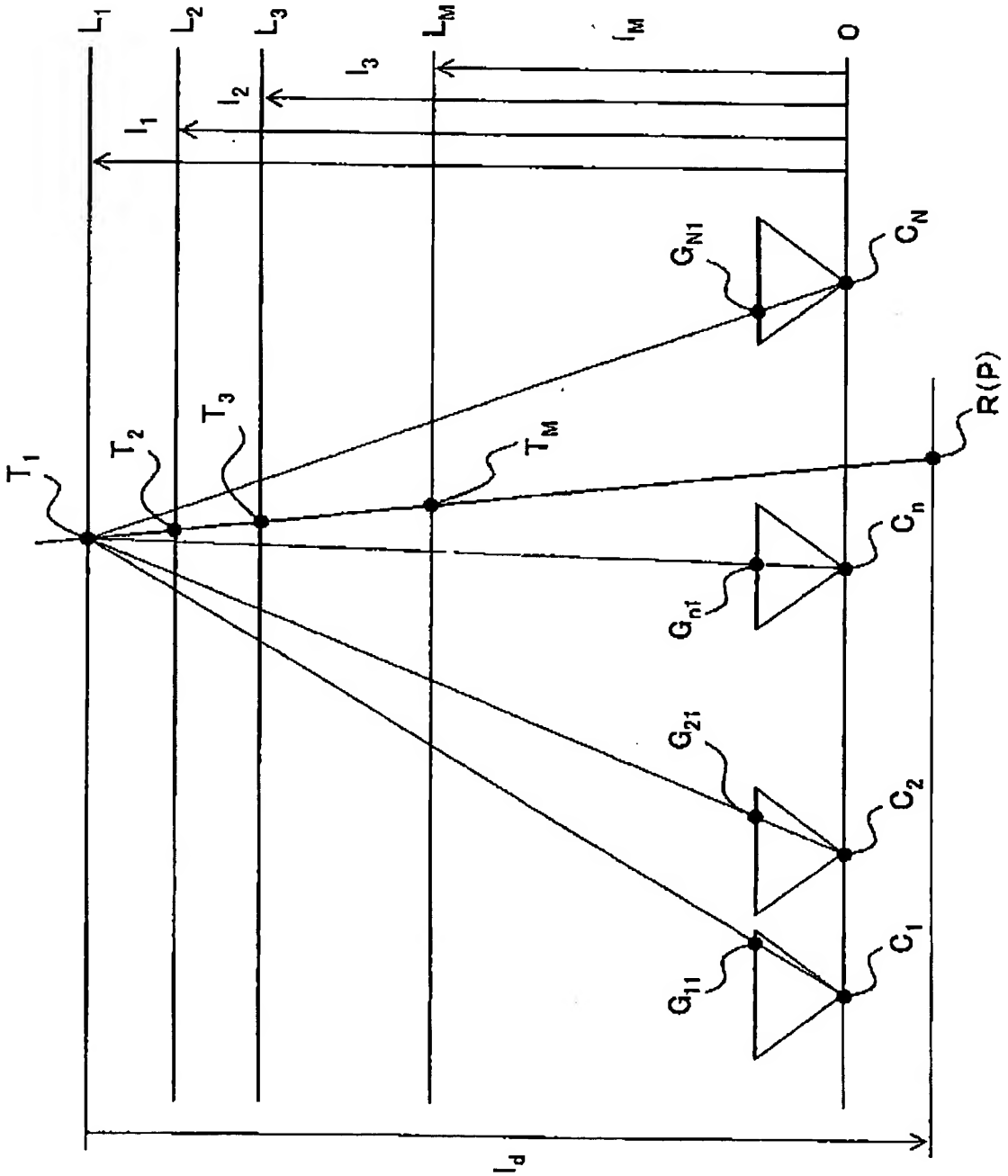

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FIG.69

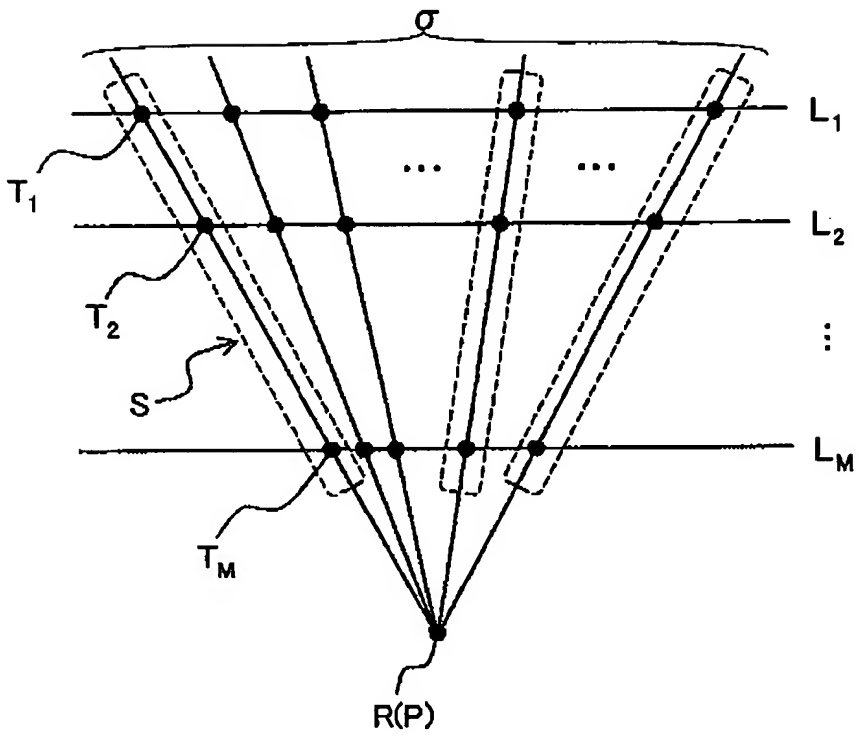

FIG.70

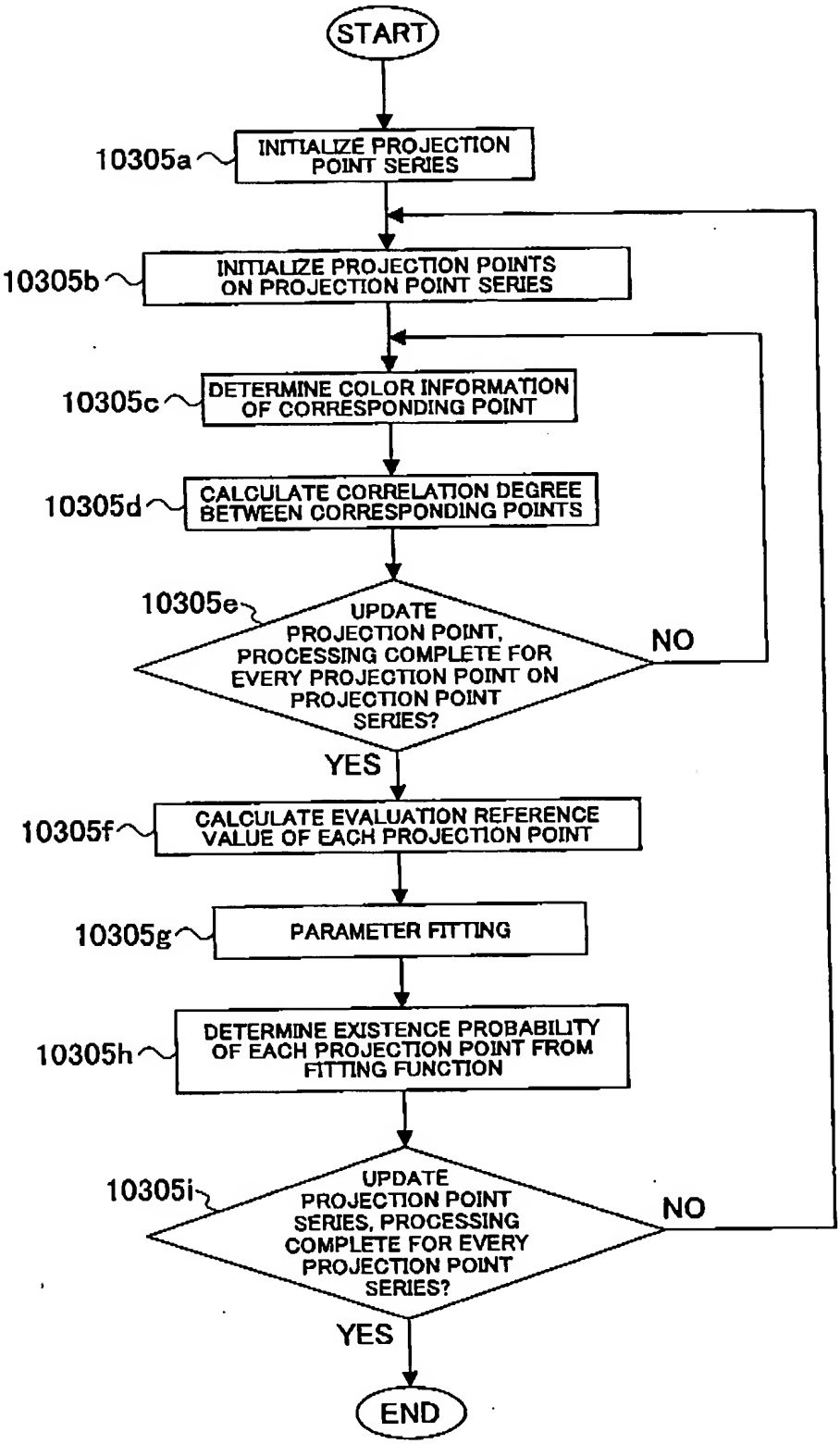
START
10305a
INITIALIZE PROJECTION POINT SERIES
10305b
INITIALIZE PROJECTION POINTS ON PROJECTION POINT SERIES
10305c
DETERMINE COLOR INFORMATION OF CORRESPONDING POINT
10305d
CALCULATE CORRELATION DEGREE BETWEEN CORRESPONDING POINTS
10305e
UPDATE PROJECTION POINT, PROCESSING COMPLETE FOR EVERY PROJECTION POINT ON PROJECTION POINT SERIES?
NO
YES
10305f
CALCULATE EVALUATION REFERENCE VALUE OF EACH PROJECTION POINT
10305g
PARAMETER FITTING
10305h
DETERMINE EXISTENCE PROBABILITY OF EACH PROJECTION POINT FROM FITTING FUNCTION
10305i
UPDATE PROJECTION POINT SERIES, PROCESSING COMPLETE FOR EVERY PROJECTION POINT SERIES?
NO
YES
END

FIG.71

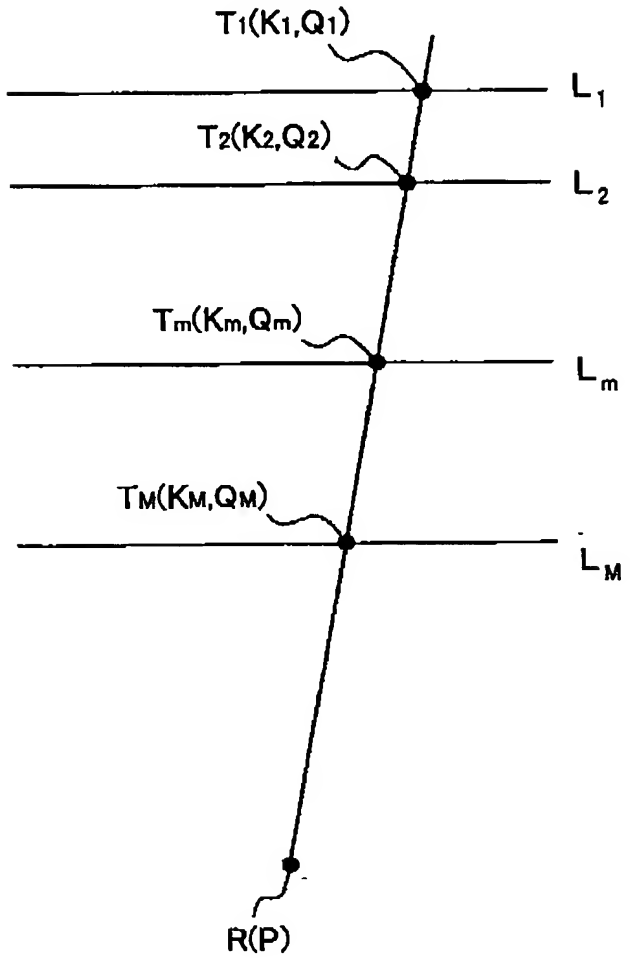

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FIG.72A

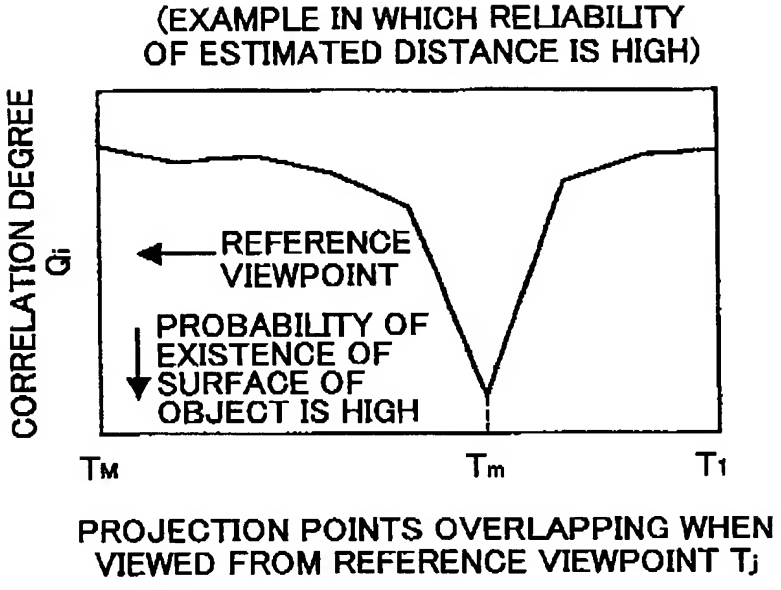

FIG.72B

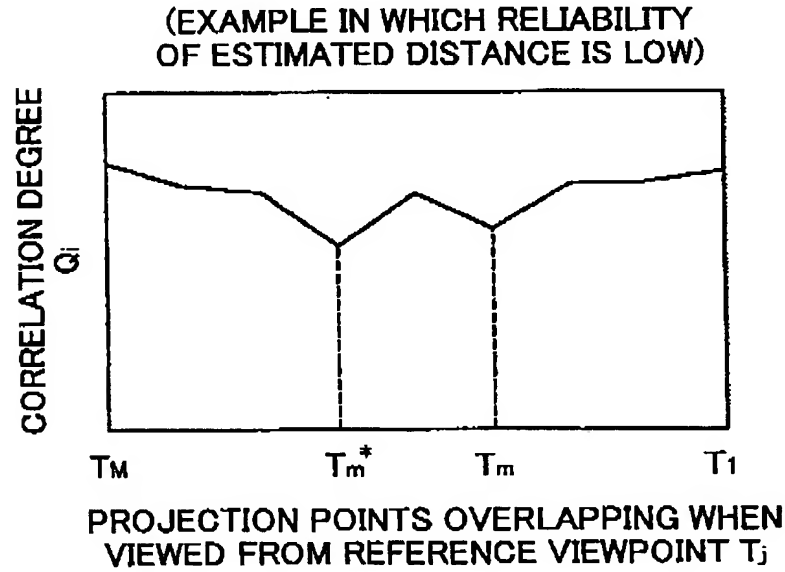

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FIG.73A

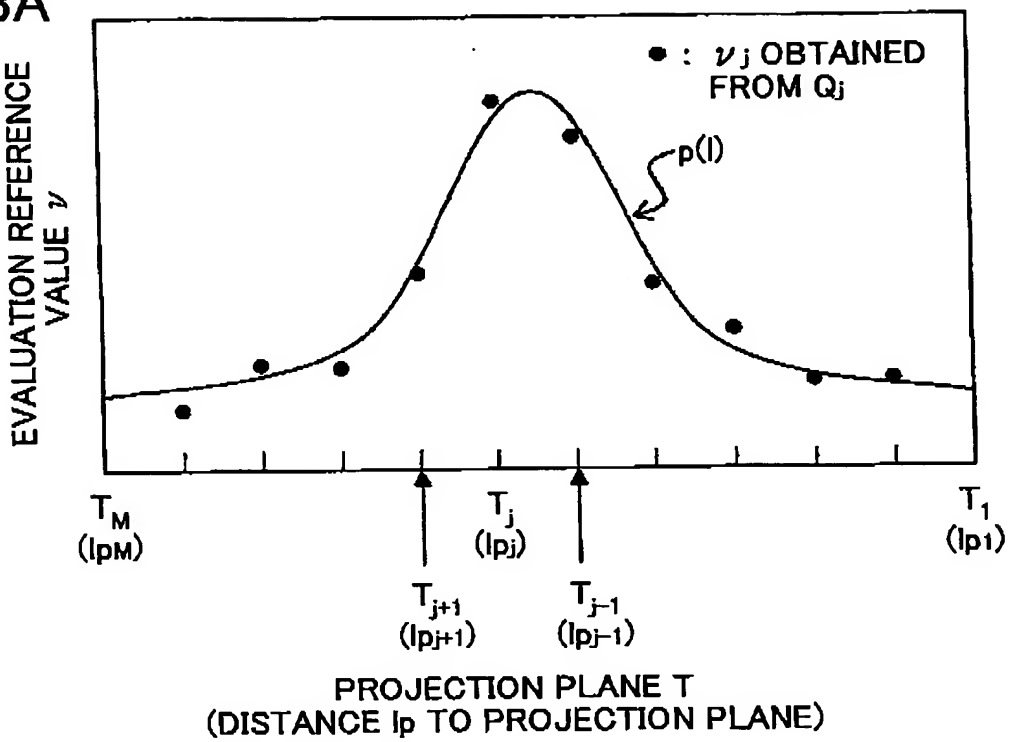

FIG.73B

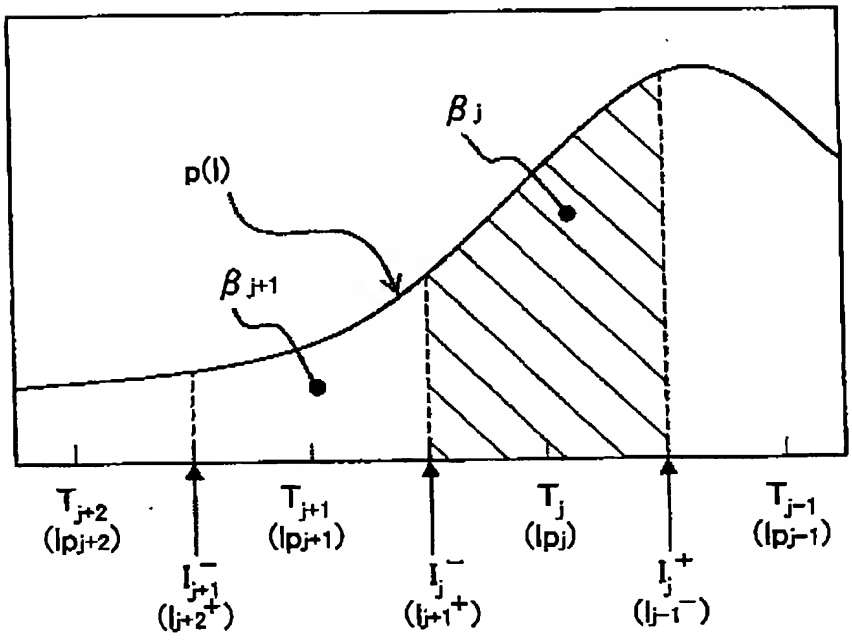

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FIG.74

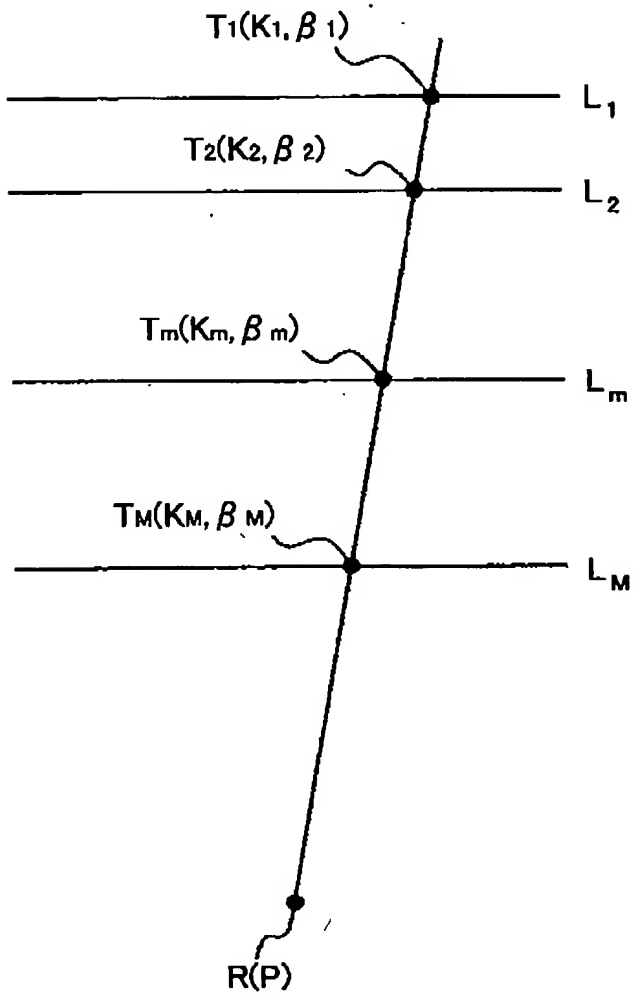

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FIG.75

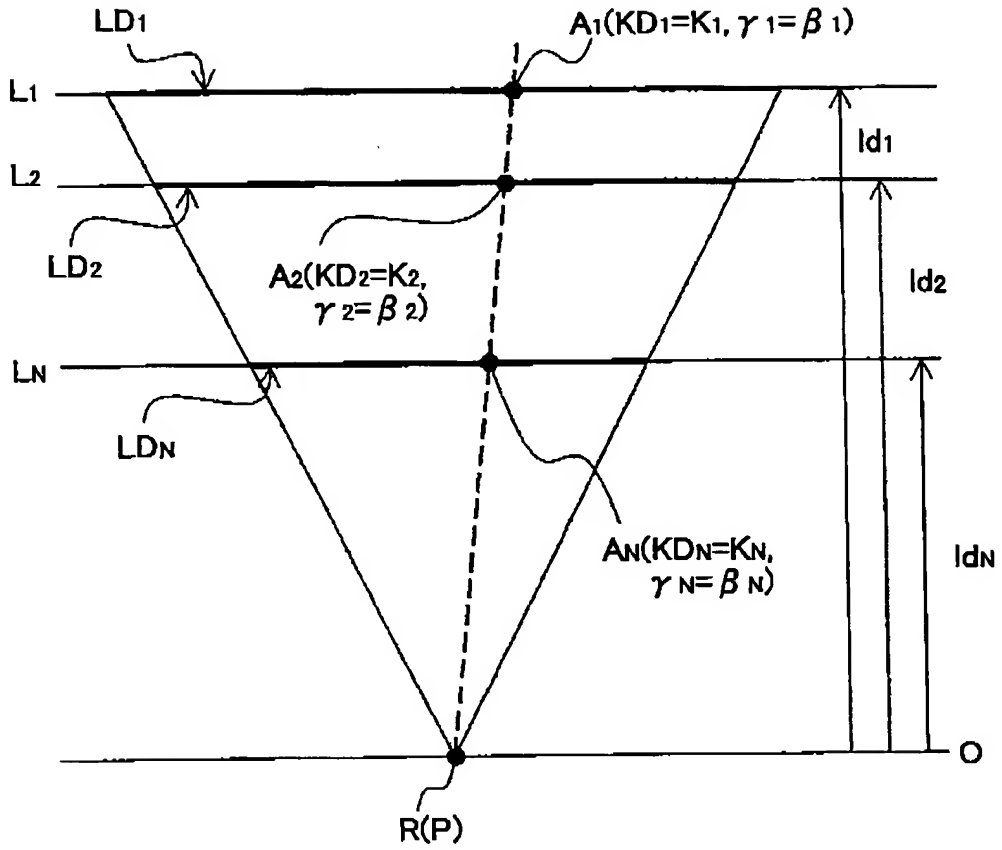

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FIG.76

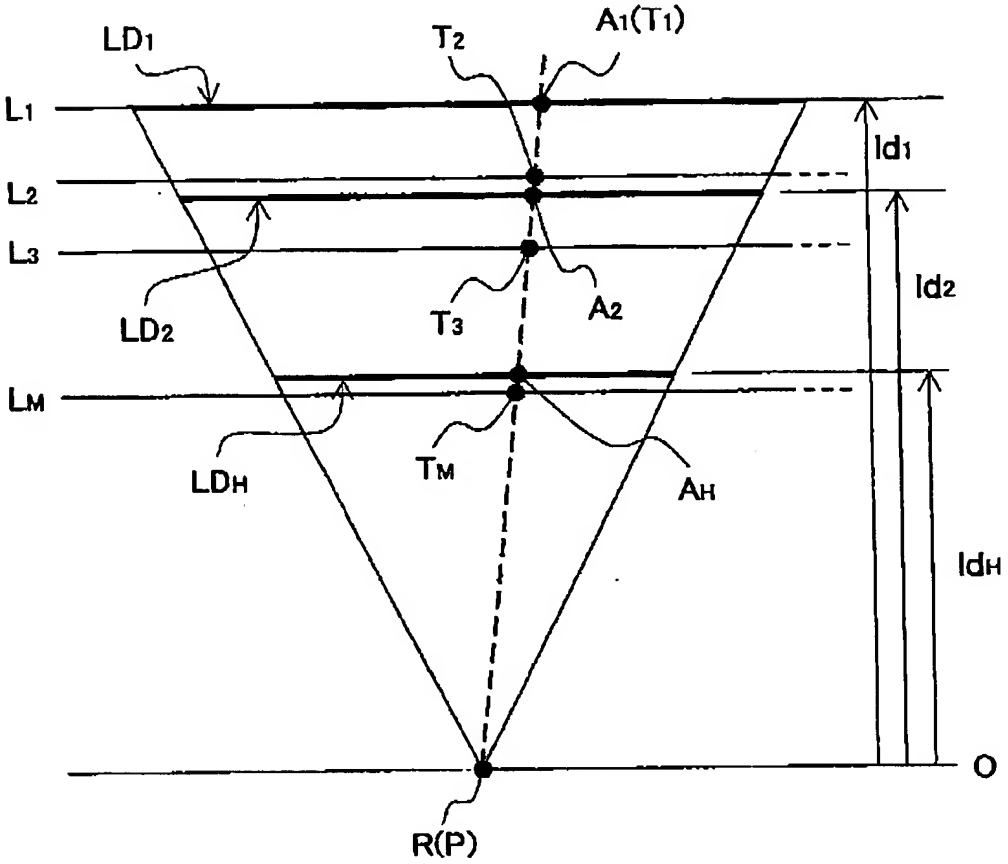

FIG.77A

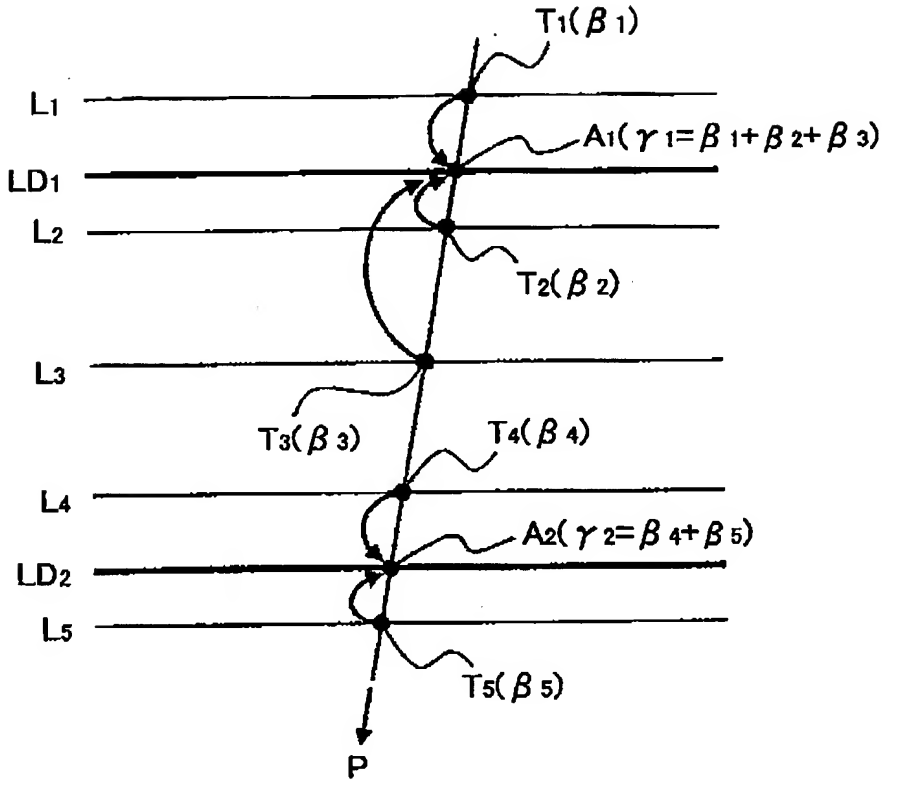

FIG.77B

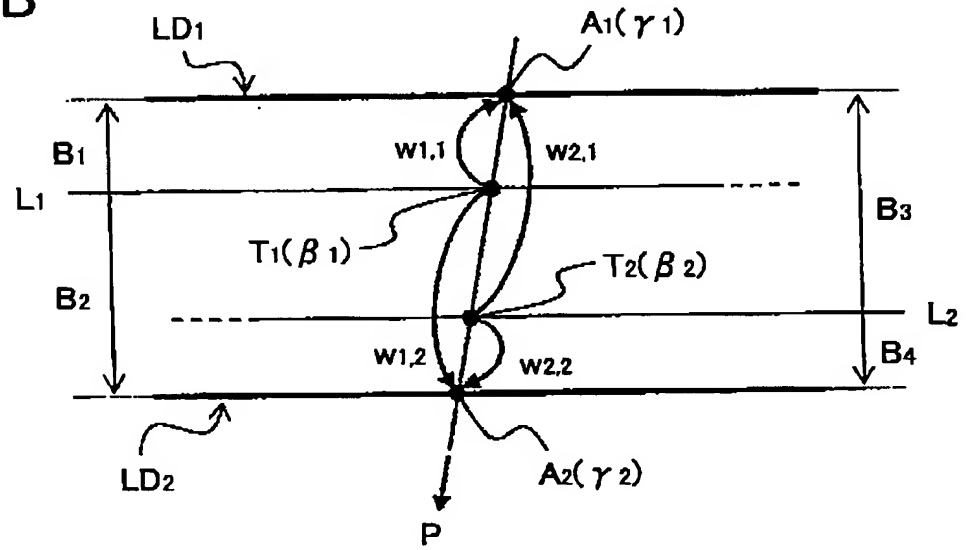

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FIG.78

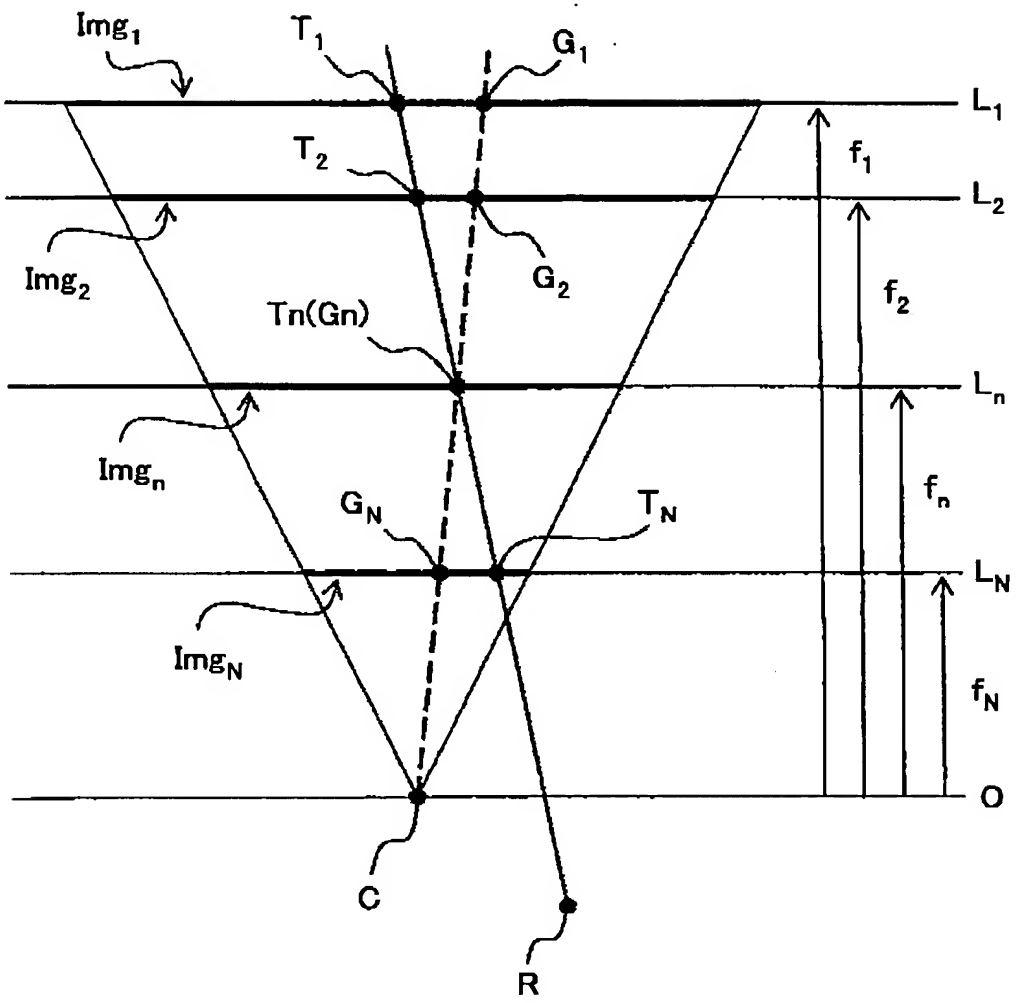

FIG.79

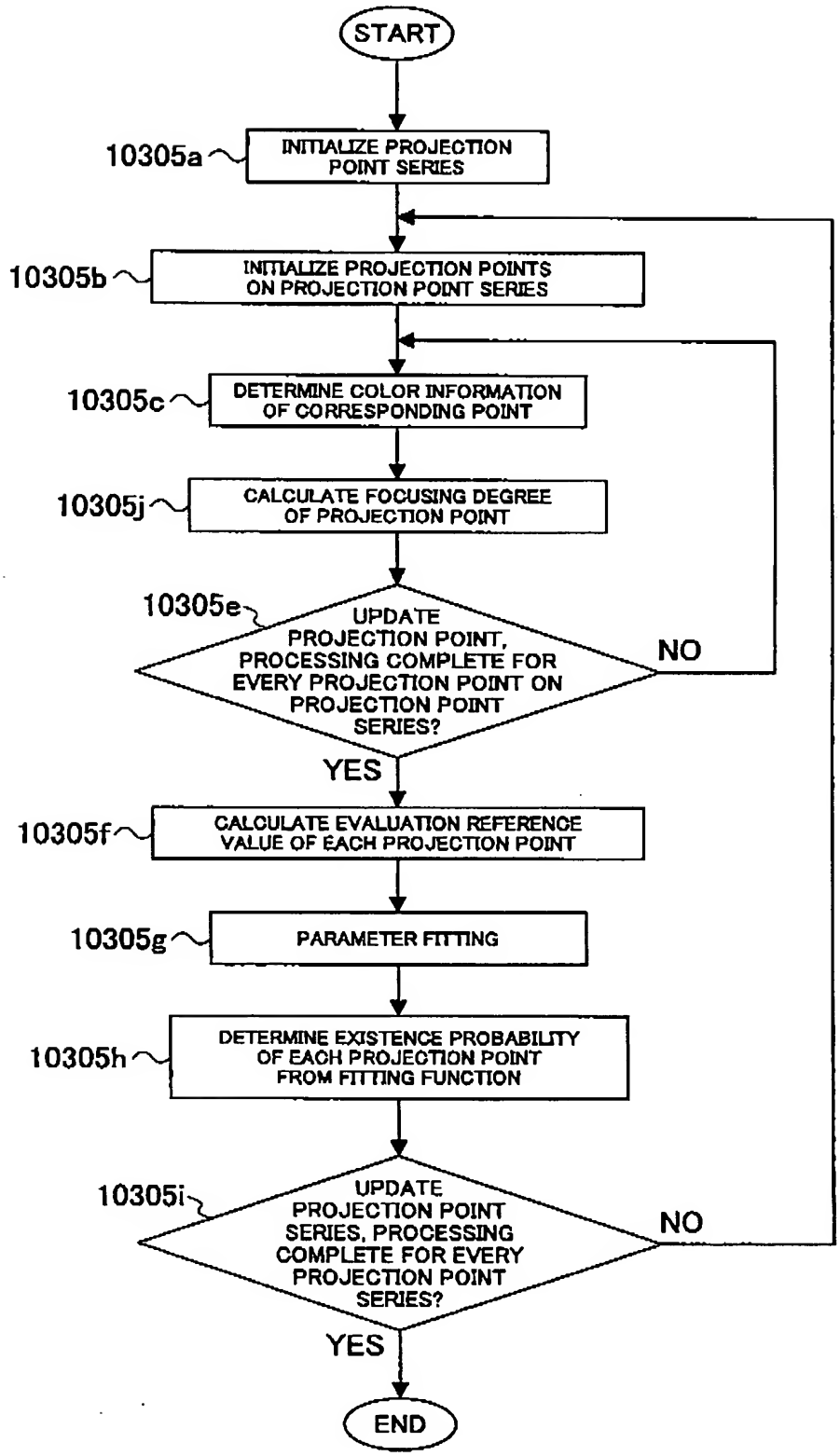
START
10305a
INITIALIZE PROJECTION POINT SERIES
10305b
INITIALIZE PROJECTION POINTS ON PROJECTION POINT SERIES
10305c
DETERMINE COLOR INFORMATION OF CORRESPONDING POINT
10305j
CALCULATE FOCUSING DEGREE OF PROJECTION POINT
10305e
UPDATE PROJECTION POINT, PROCESSING COMPLETE FOR EVERY PROJECTION POINT ON PROJECTION POINT SERIES?
NO
YES
10305f
CALCULATE EVALUATION REFERENCE VALUE OF EACH PROJECTION POINT
10305g
PARAMETER FITTING
10305h
DETERMINE EXISTENCE PROBABILITY OF EACH PROJECTION POINT FROM FITTING FUNCTION
10305i
UPDATE PROJECTION POINT SERIES, PROCESSING COMPLETE FOR EVERY PROJECTION POINT SERIES?
NO
YES
END

FIG.80

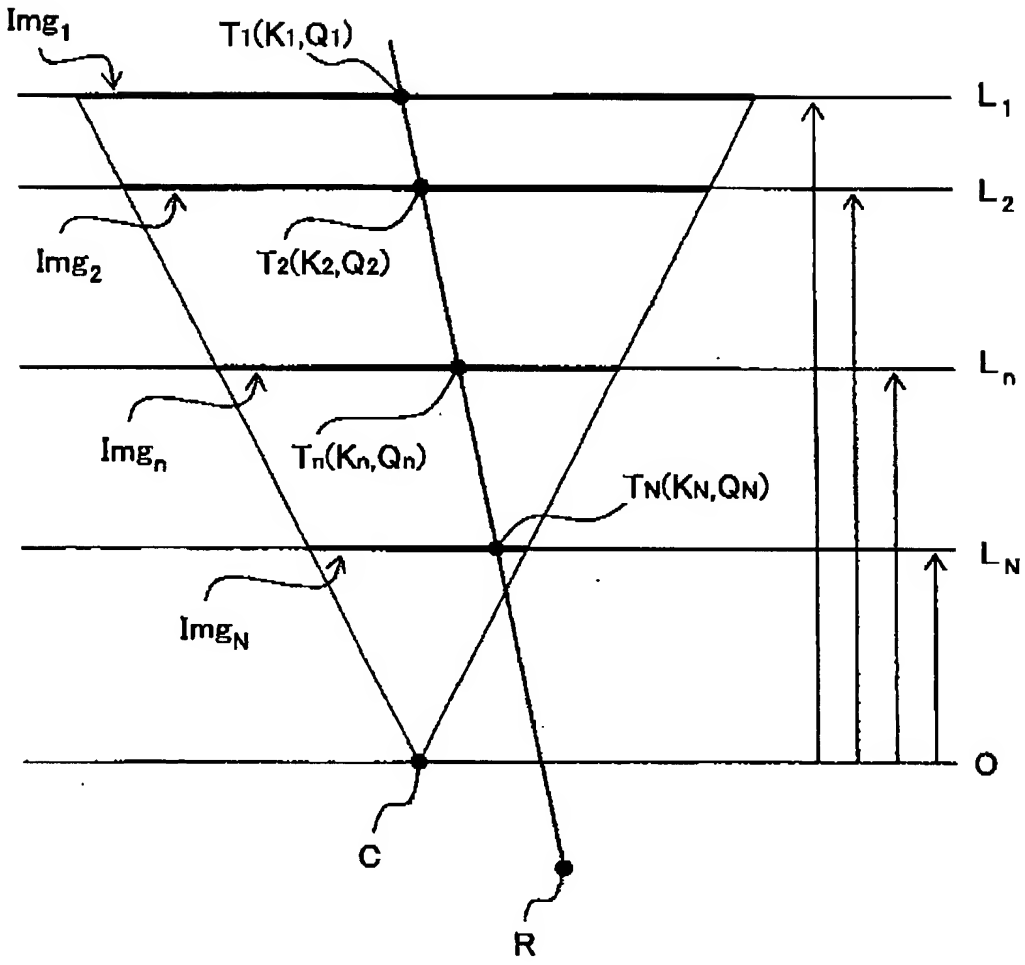
Img1
T1(K1,Q1)
L1
L2
Img2
T2(K2,Q2)
Ln
Imgn
Tn(Kn,Qn)
TN(KN,QN)
LN
ImgN
O
C
R

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FIG.81

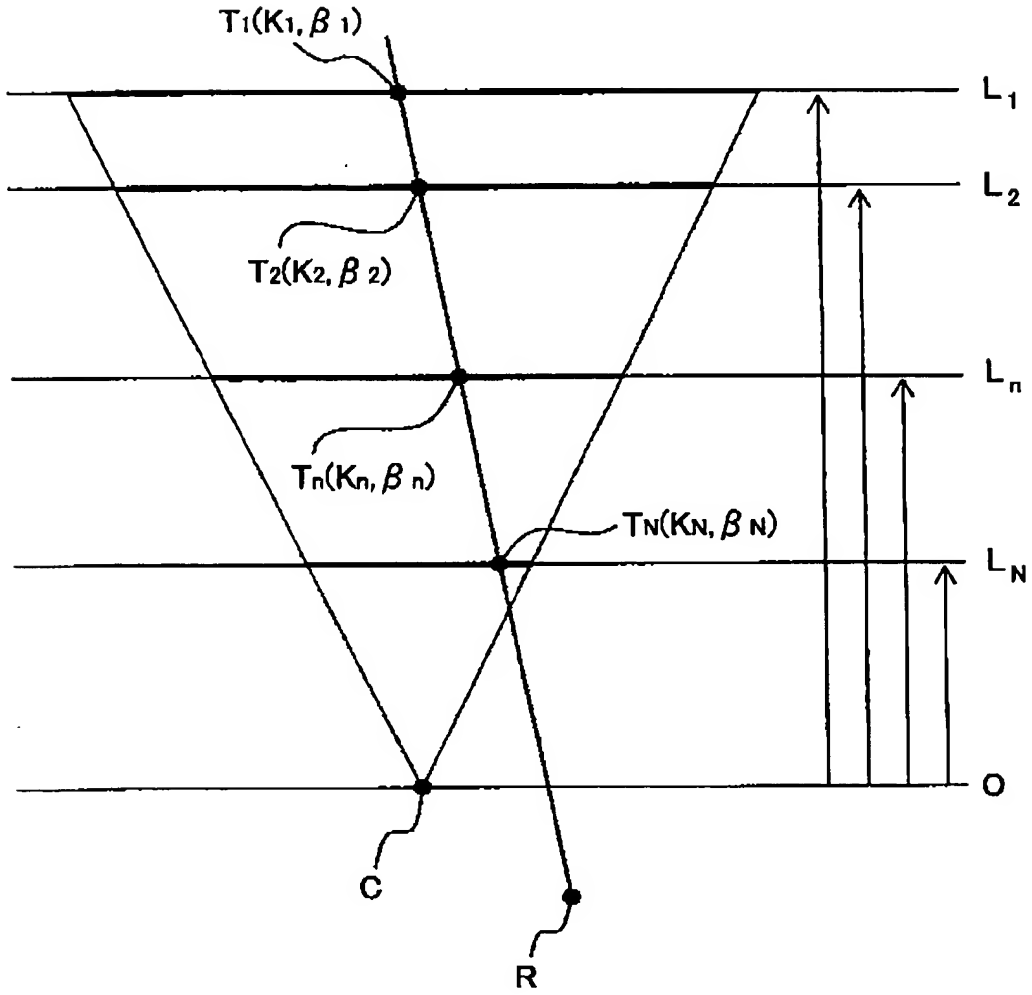

FIG.82

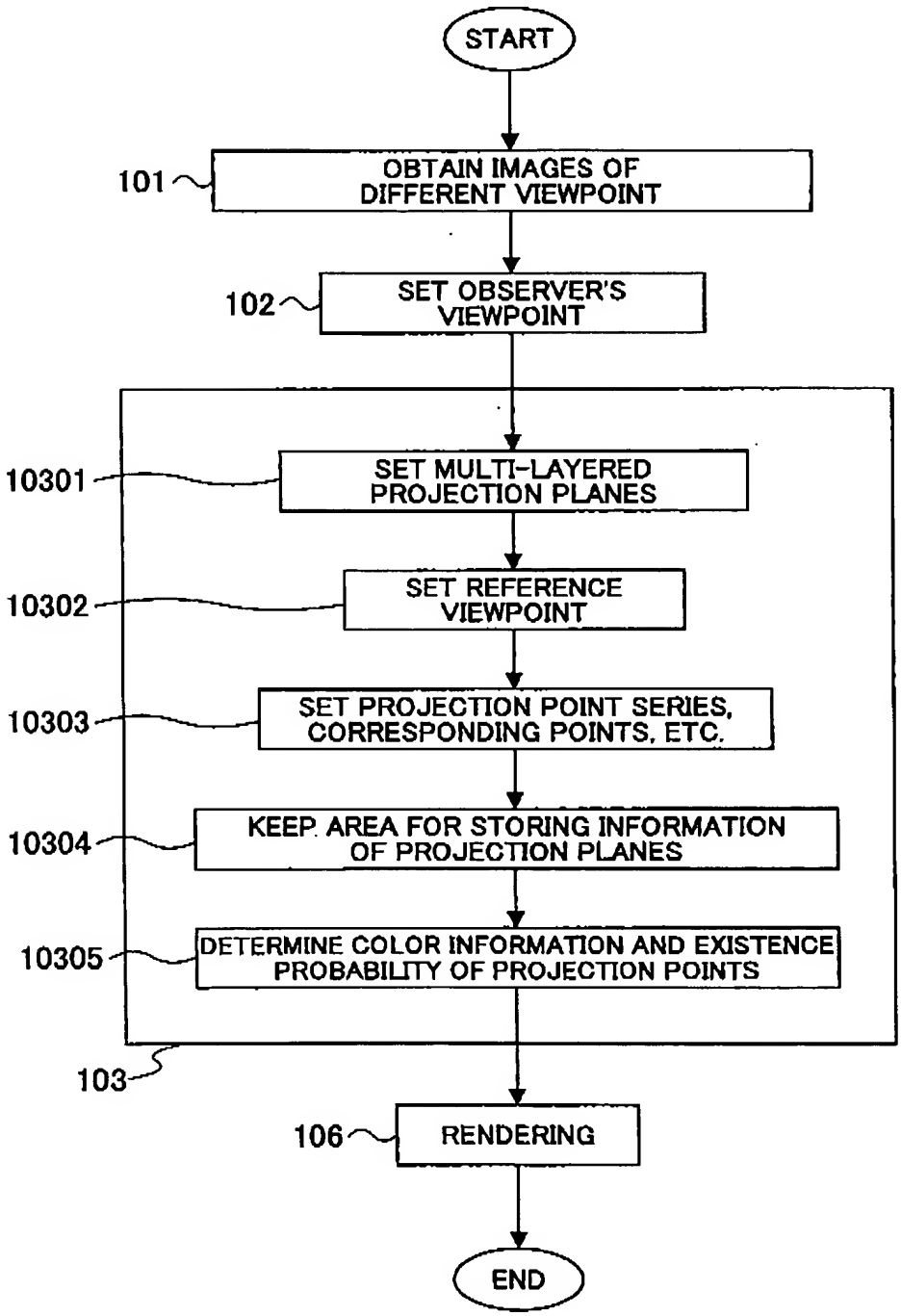
START
101
OBTAIN IMAGES OF DIFFERENT VIEWPOINT
102
SET OBSERVER'S VIEWPOINT
10301
SET MULTI-LAYERED PROJECTION PLANES
10302
SET REFERENCE VIEWPOINT
10303
SET PROJECTION POINT SERIES, CORRESPONDING POINTS, ETC.
10304
KEEP AREA FOR STORING INFORMATION OF PROJECTION PLANES
10305
DETERMINE COLOR INFORMATION AND EXISTENCE PROBABILITY OF PROJECTION POINTS
103
106
RENDERING
END

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FIG.83

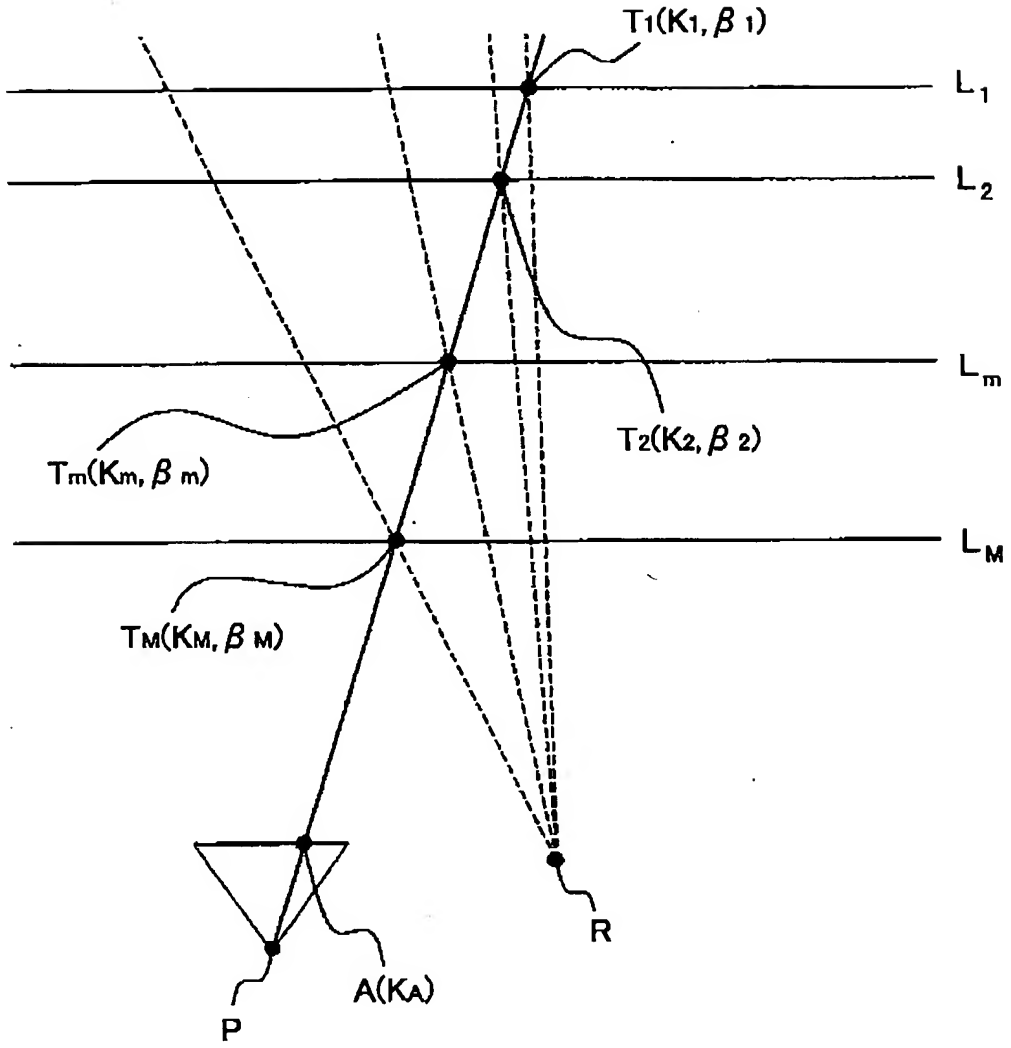

FIG.84A

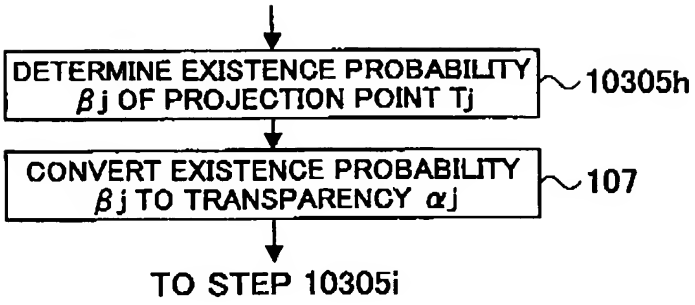

FIG.84B

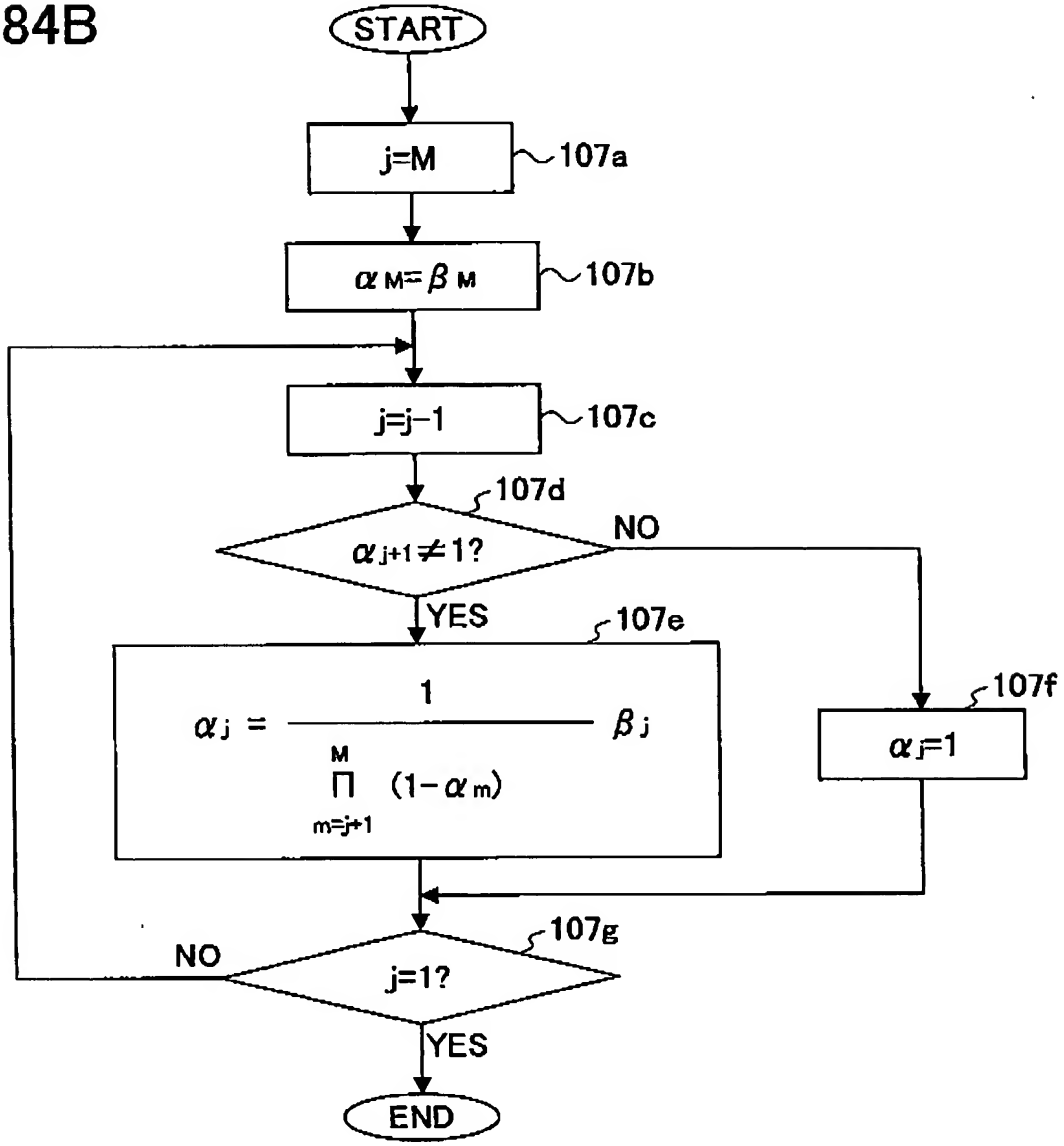

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FIG.85

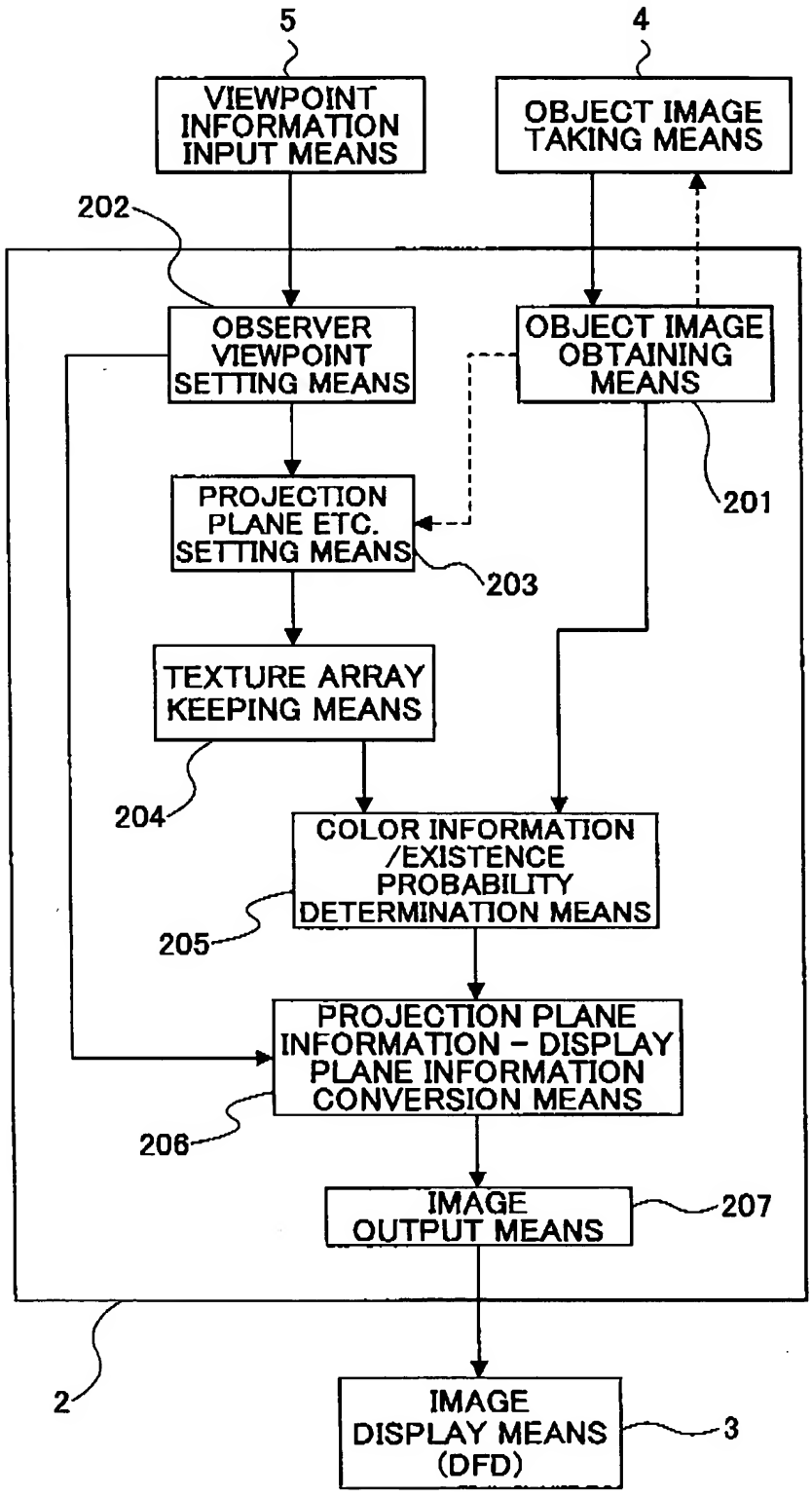

FIG.86

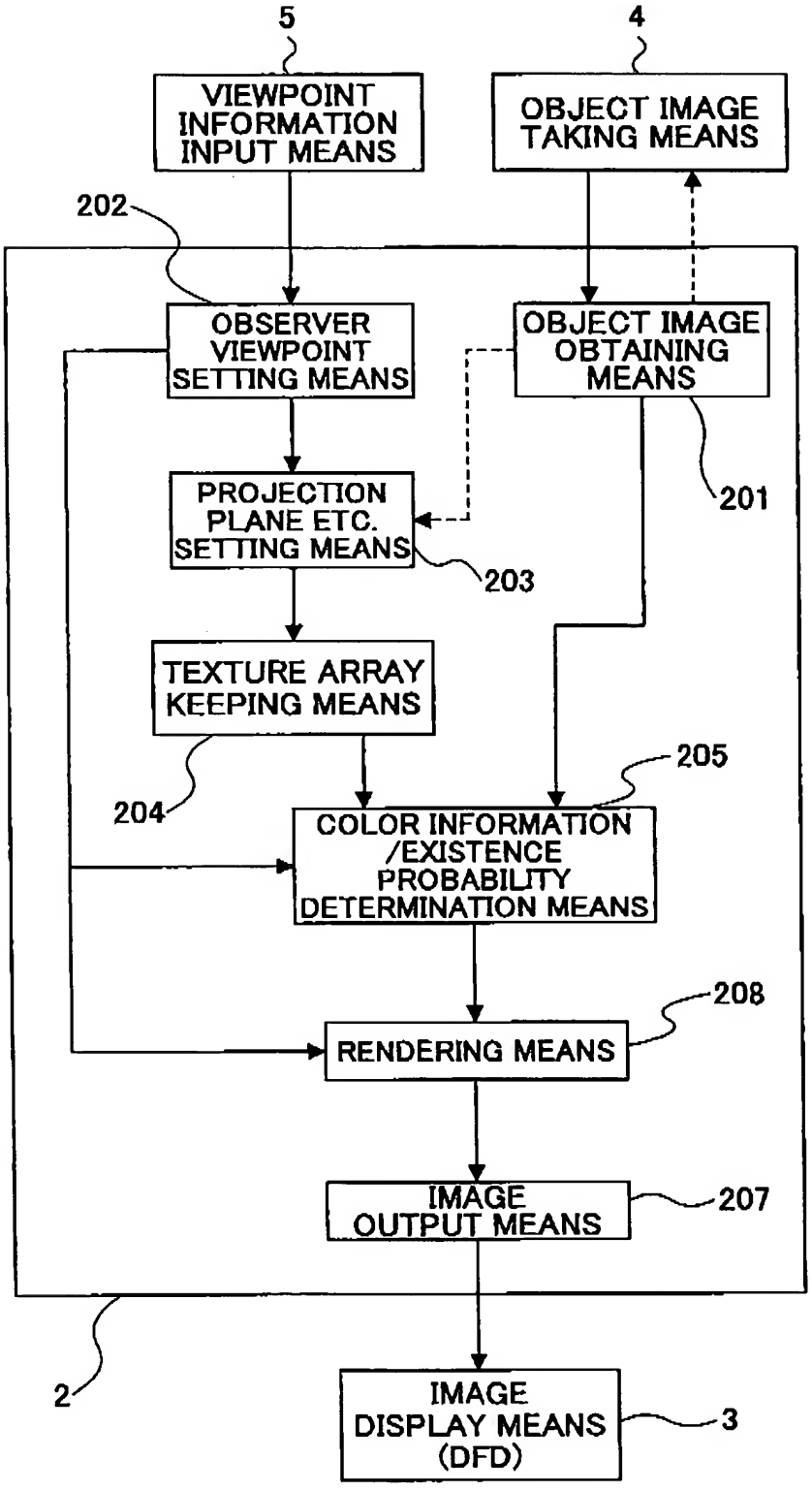
5
4
VIEWPOINT INFORMATION INPUT MEANS
OBJECT IMAGE TAKING MEANS
202
OBSERVER VIEWPOINT SETTING MEANS
OBJECT IMAGE OBTAINING MEANS
201
PROJECTION PLANE ETC. SETTING MEANS
203
TEXTURE ARRAY KEEPING MEANS
204
205
COLOR INFORMATION /EXISTENCE PROBABILITY DETERMINATION MEANS
208
RENDERING MEANS
IMAGE OUTPUT MEANS
207
2
IMAGE DISPLAY MEANS (DFD)
3

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FIG.87

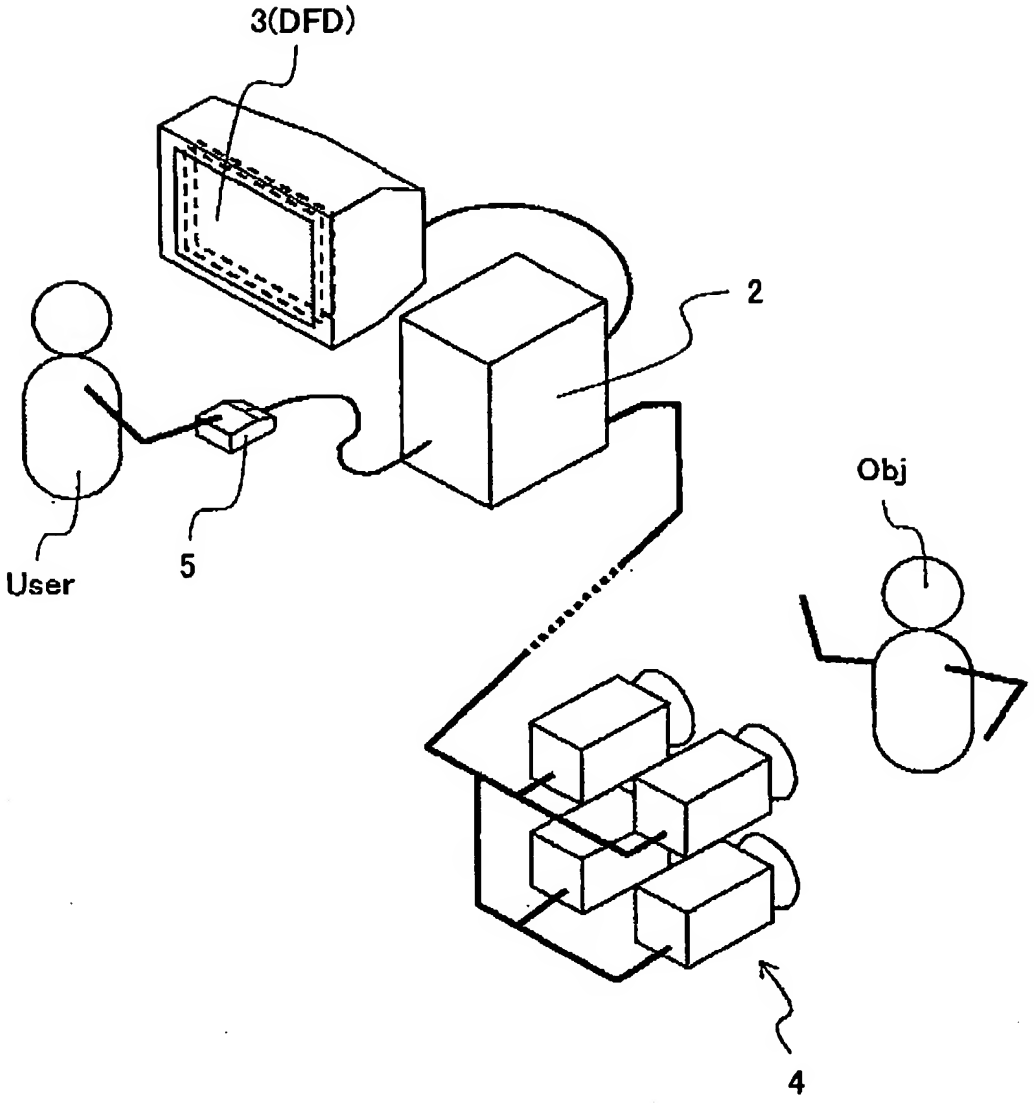

FIG.88

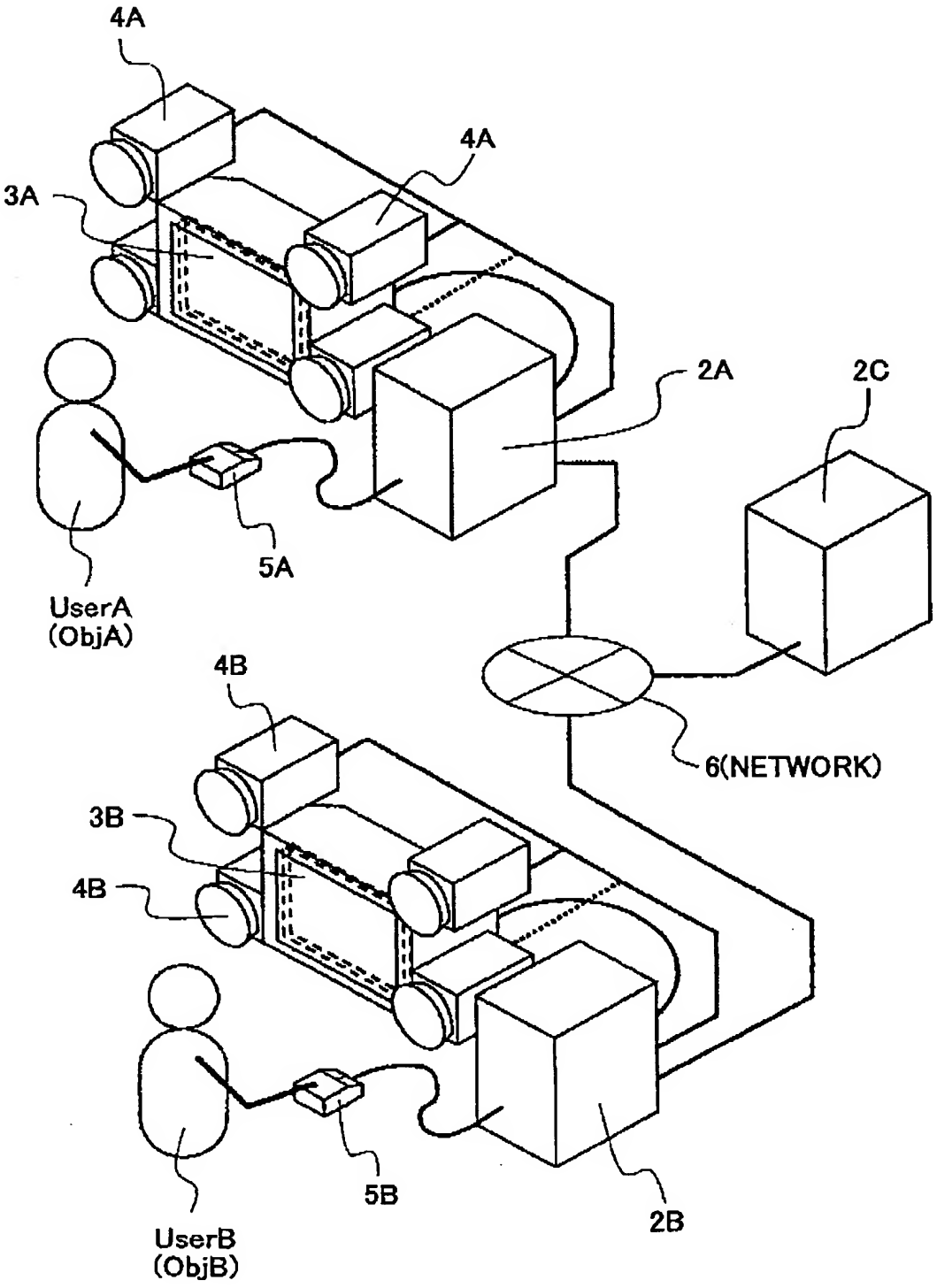

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FIG.89

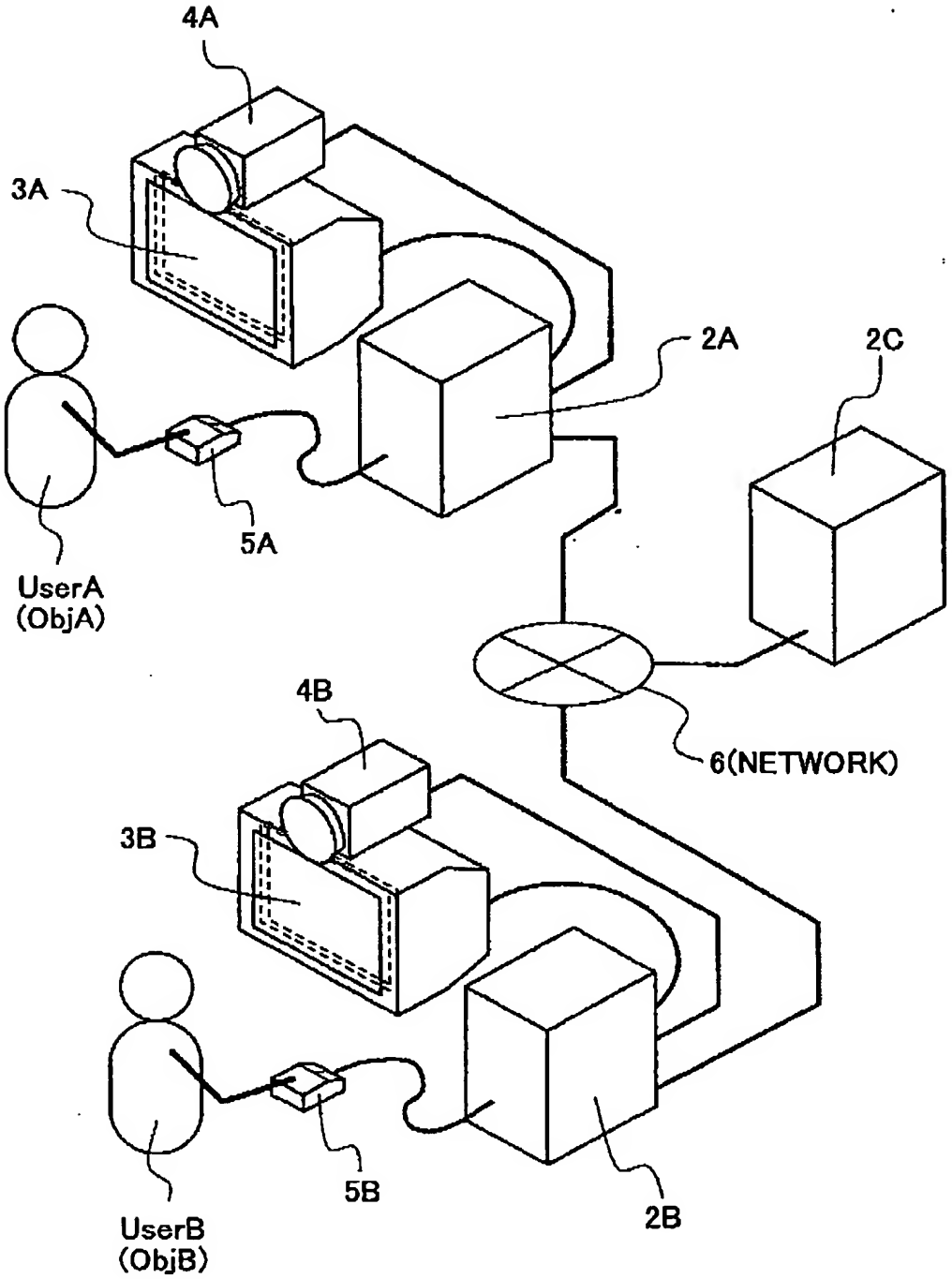

FIG.90

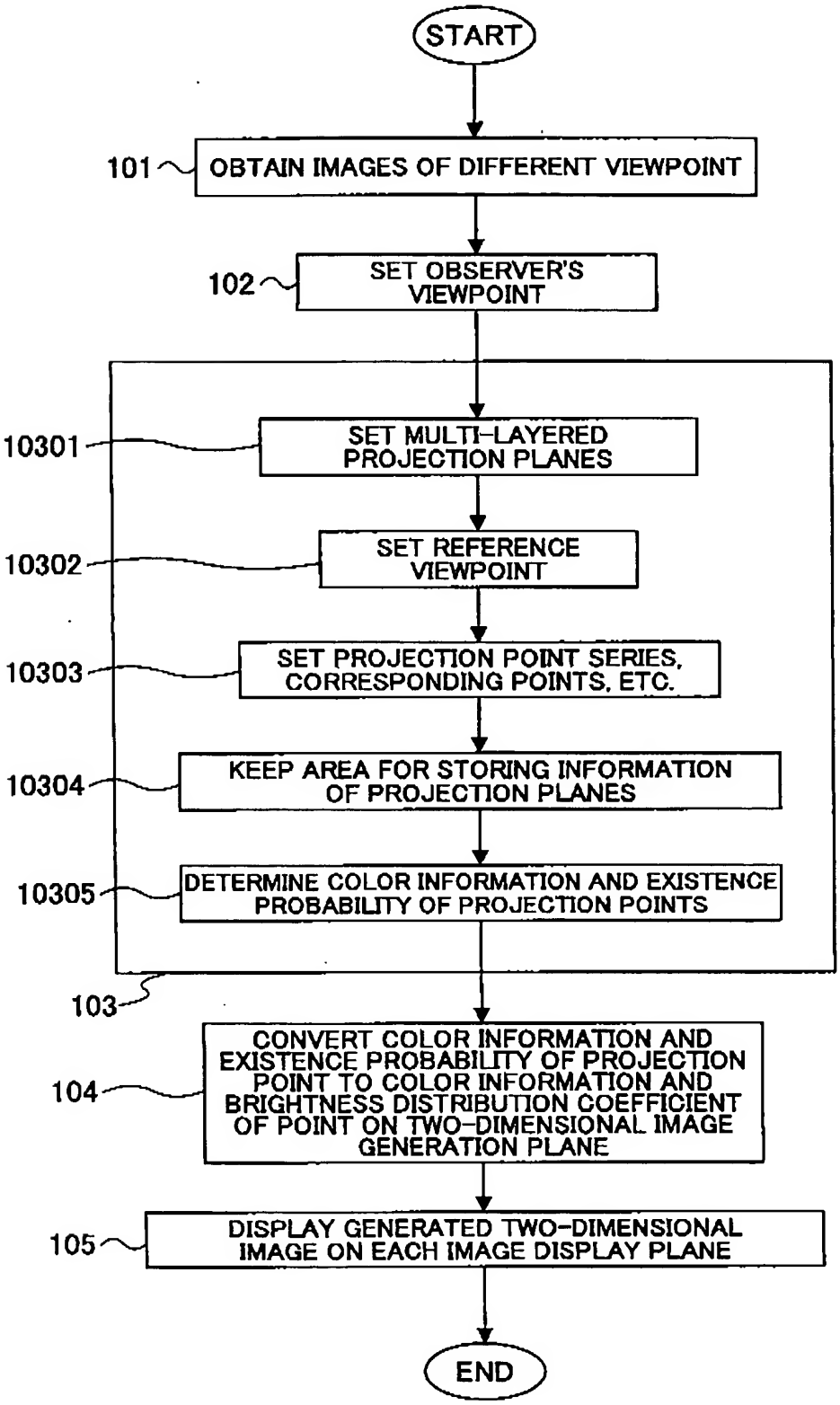
START
101
OBTAIN IMAGES OF DIFFERENT VIEWPOINT
102
SET OBSERVER'S VIEWPOINT
10301
SET MULTI-LAYERED PROJECTION PLANES
10302
SET REFERENCE VIEWPOINT
10303
SET PROJECTION POINT SERIES, CORRESPONDING POINTS, ETC.
10304
KEEP AREA FOR STORING INFORMATION OF PROJECTION PLANES
10305
DETERMINE COLOR INFORMATION AND EXISTENCE PROBABILITY OF PROJECTION POINTS
103
104
CONVERT COLOR INFORMATION AND EXISTENCE PROBABILITY OF PROJECTION POINT TO COLOR INFORMATION AND BRIGHTNESS DISTRIBUTION COEFFICIENT OF POINT ON TWO-DIMENSIONAL IMAGE GENERATION PLANE
105
DISPLAY GENERATED TWO-DIMENSIONAL IMAGE ON EACH IMAGE DISPLAY PLANE
END

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FIG.91

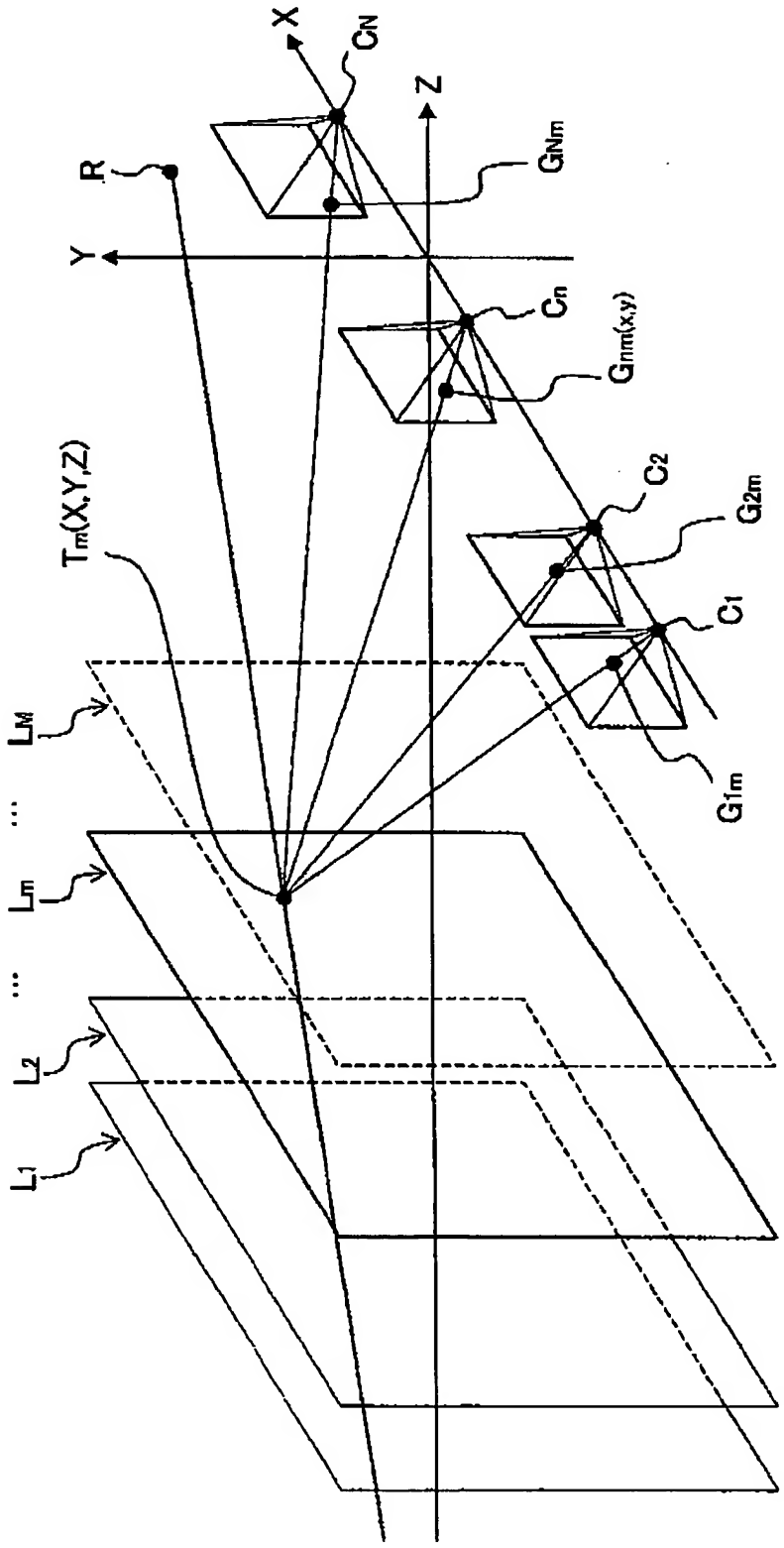

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FIG.92

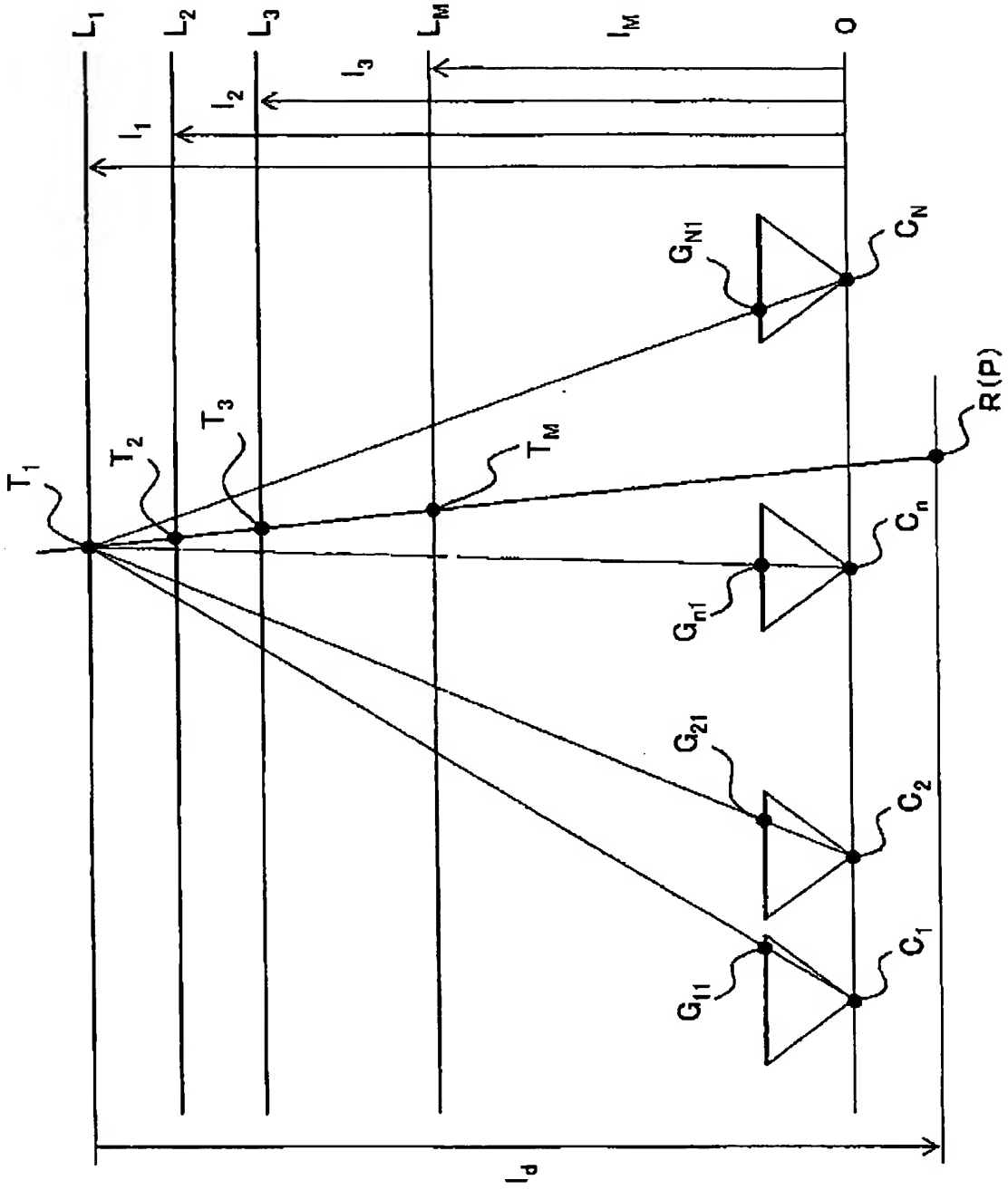

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FIG.93

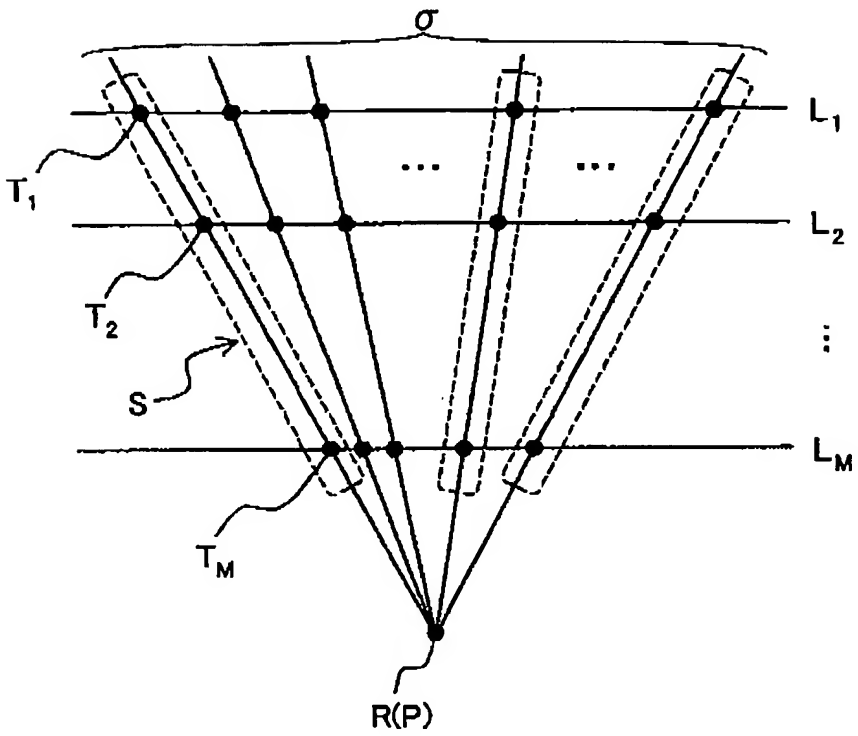

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FIG.94

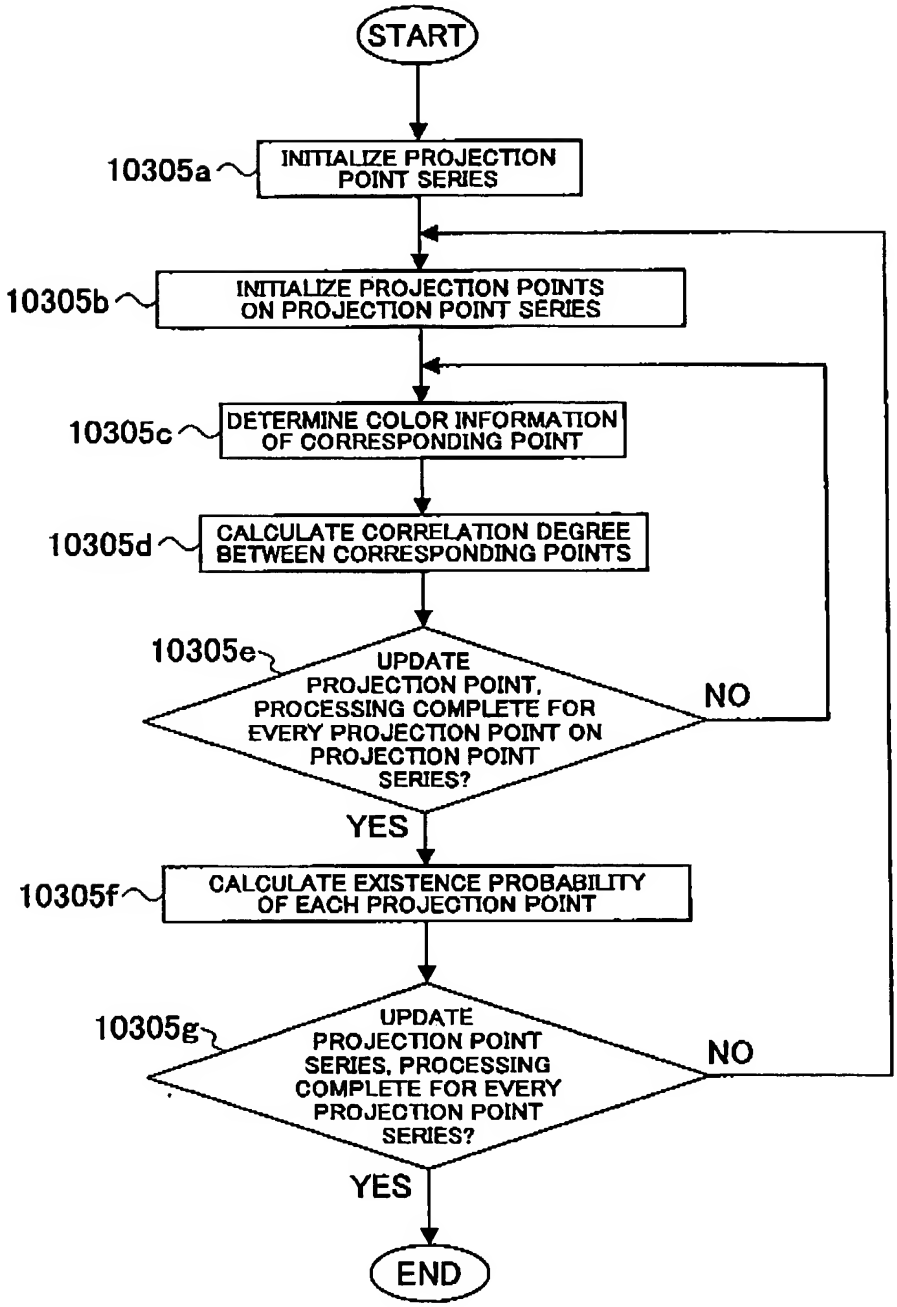

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FIG.95

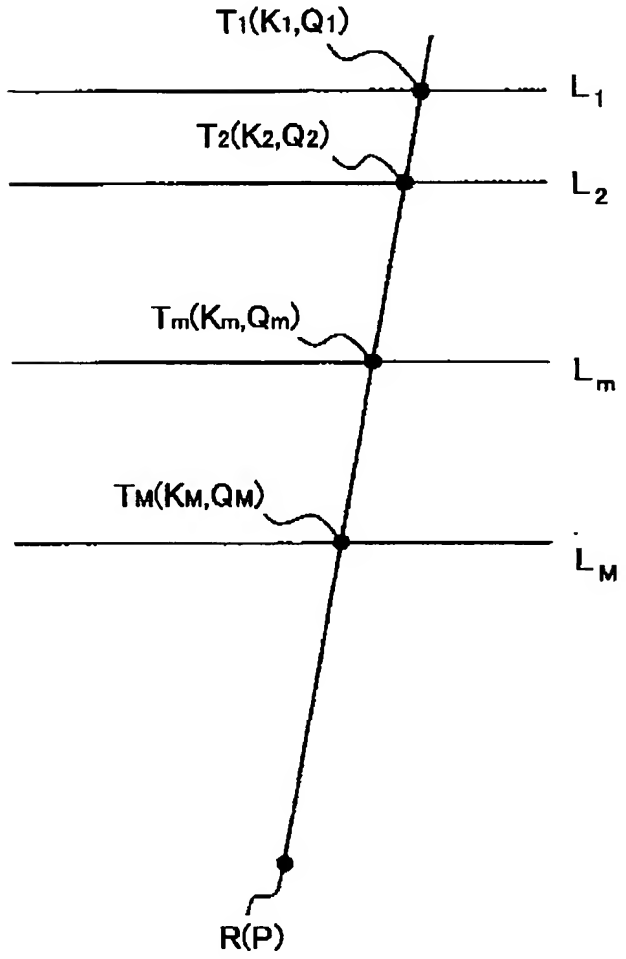

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FIG.96A

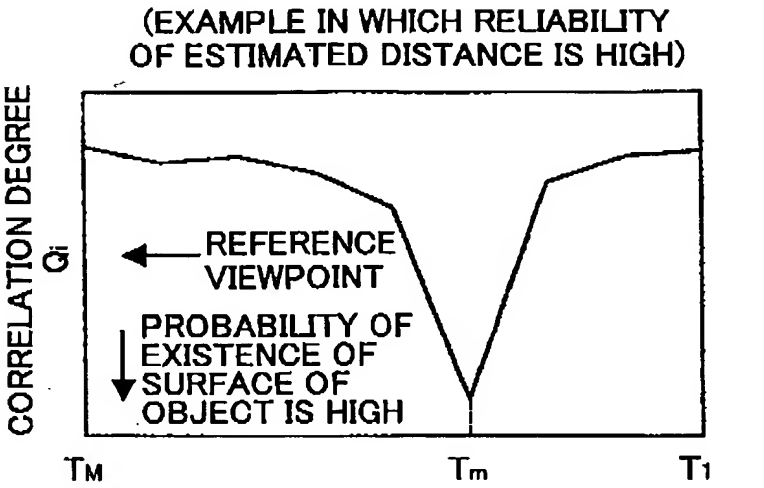

FIG.96B

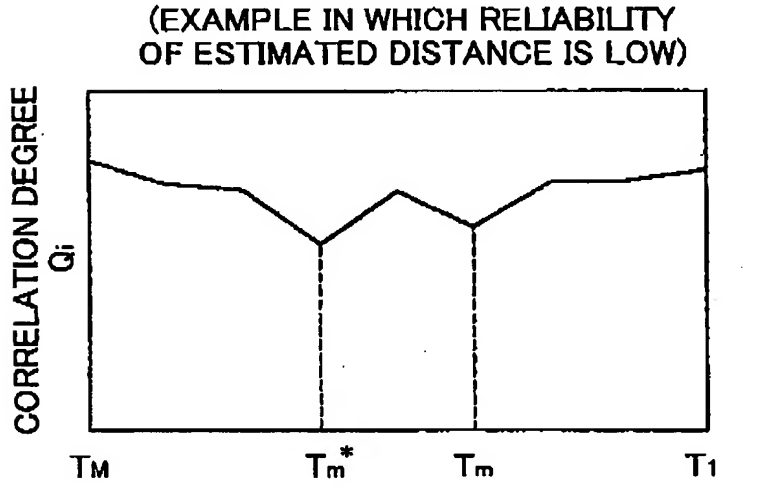

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FIG.97

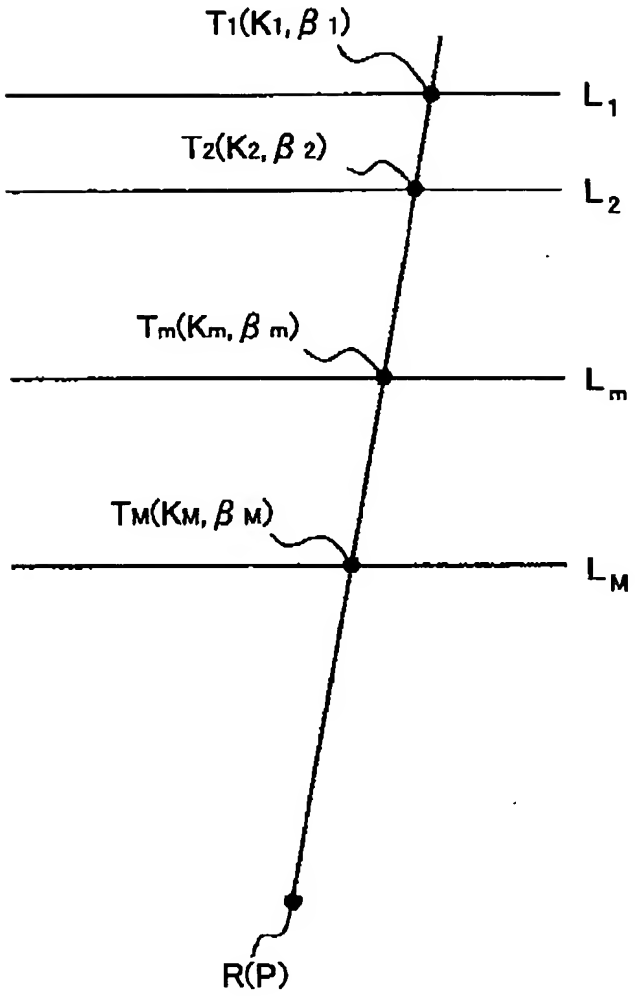

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FIG.98

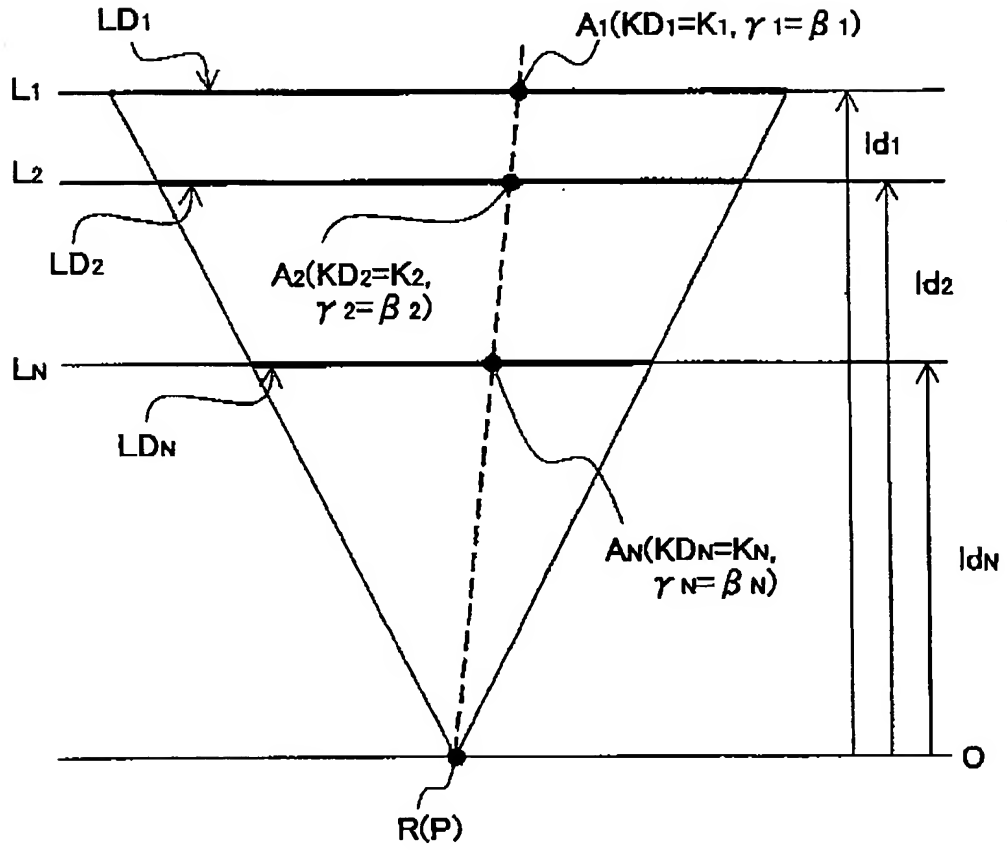

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FIG.99

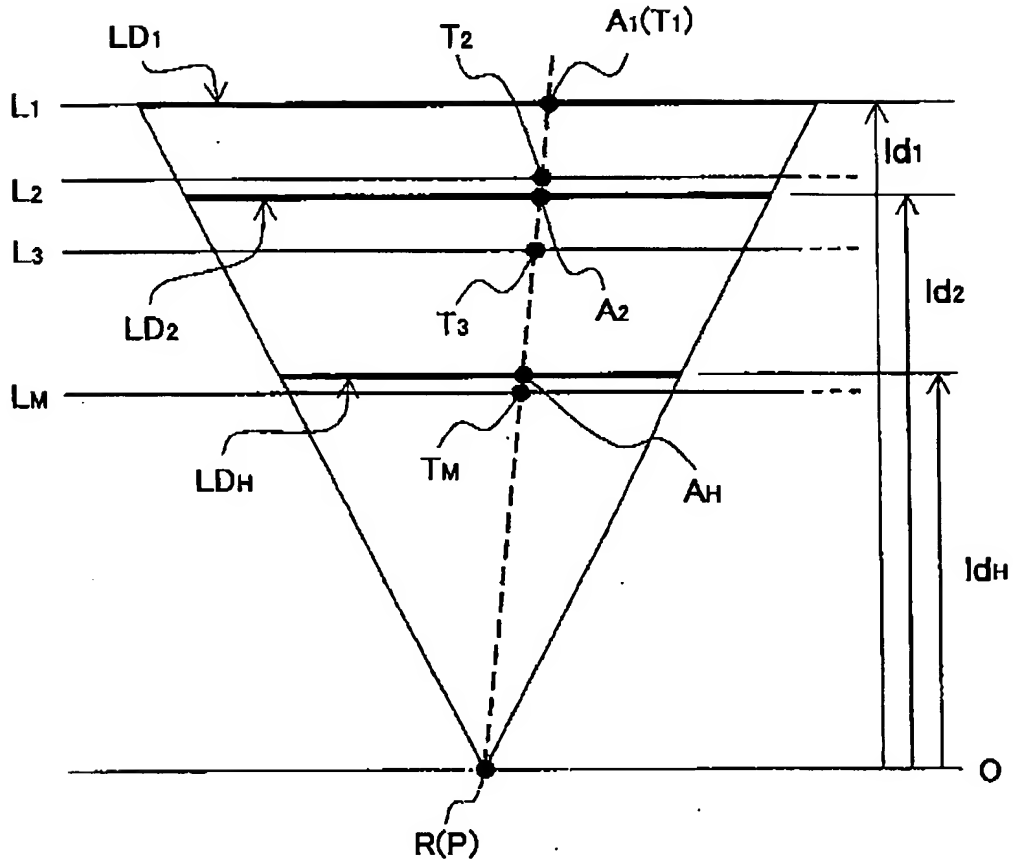

FIG.100A

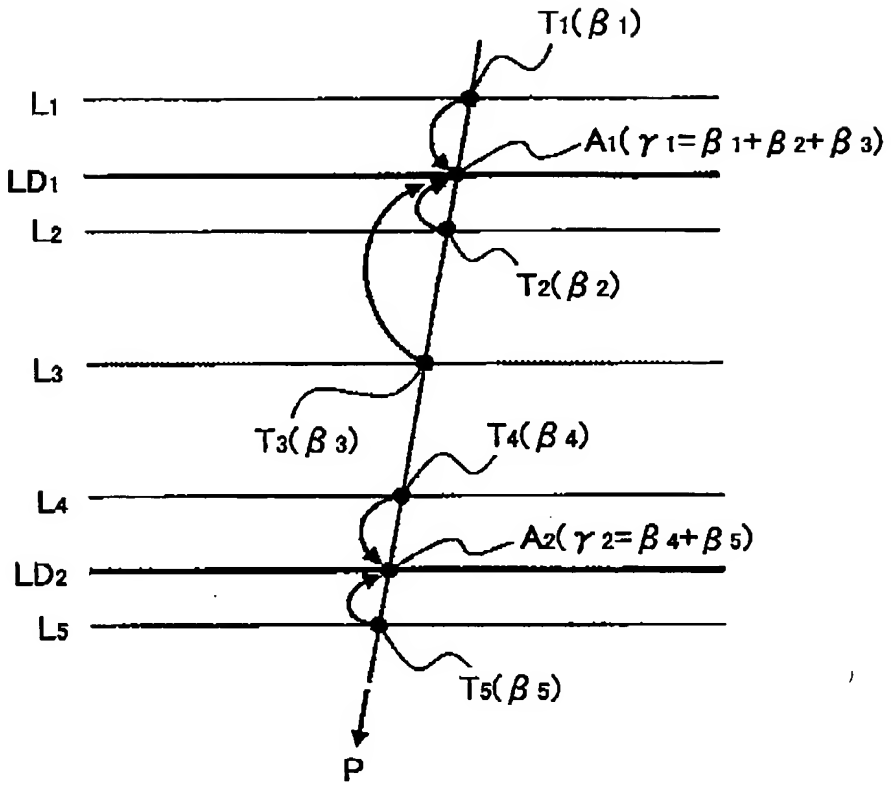

FIG.100B

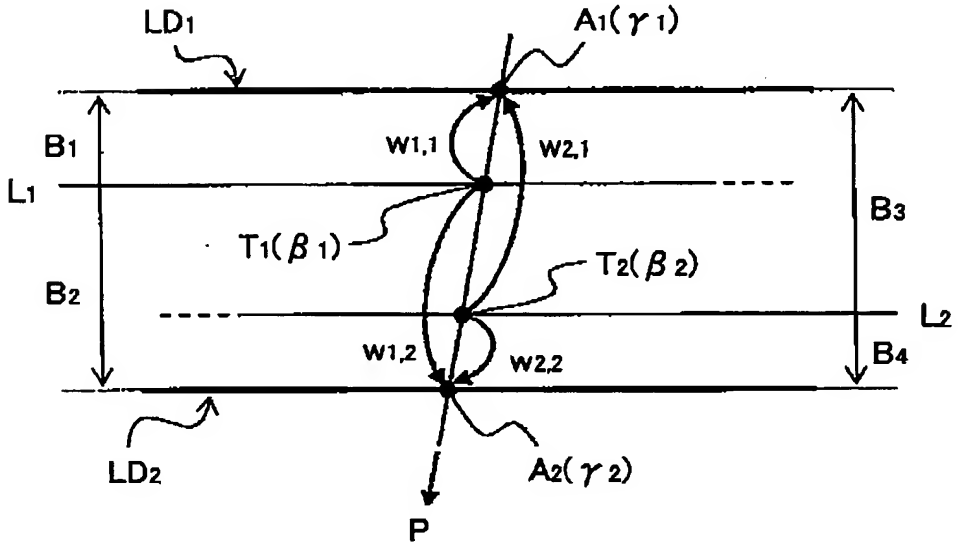

FIG.101

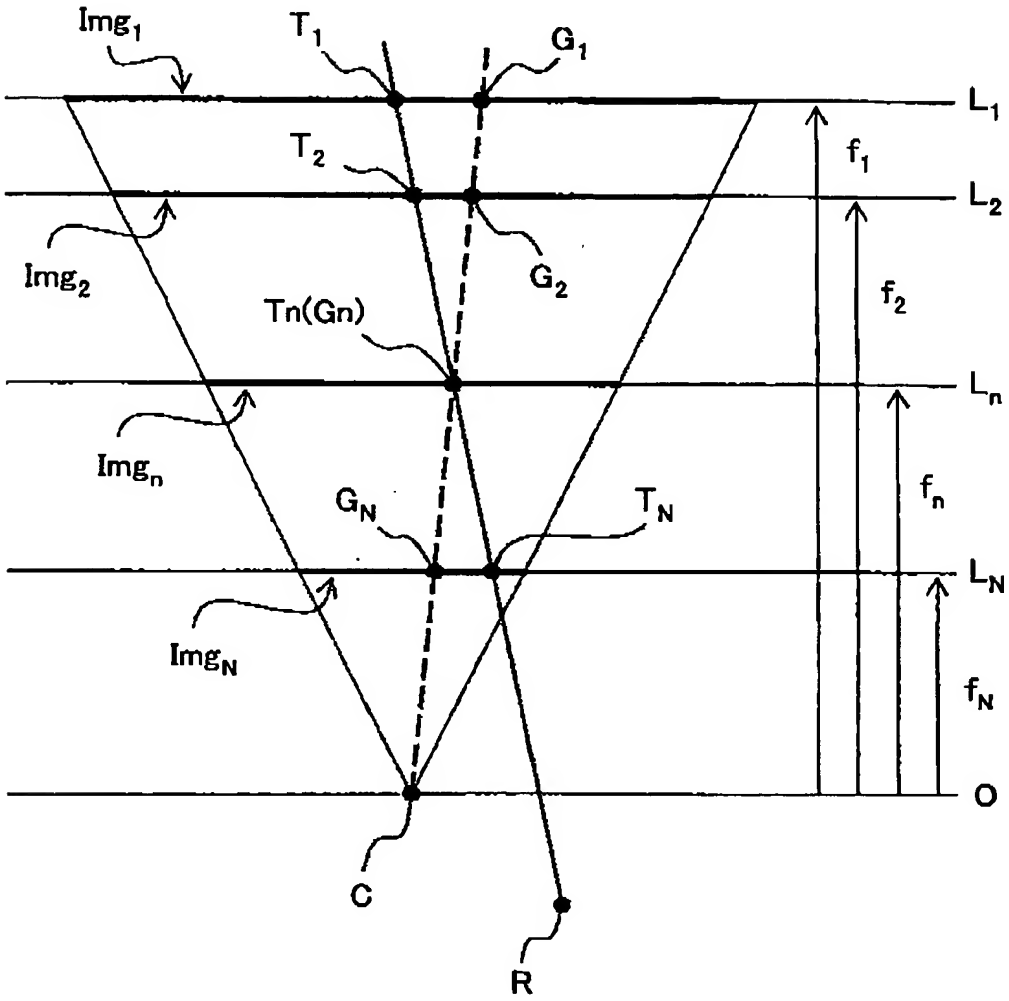
Img1
T1
G1
L1
T2
f1
L2
Img2
G2
f2
Tn(Gn)
Ln
Imgn
fn
GN
TN
LN
ImgN
fN
O
C
R

FIG.102

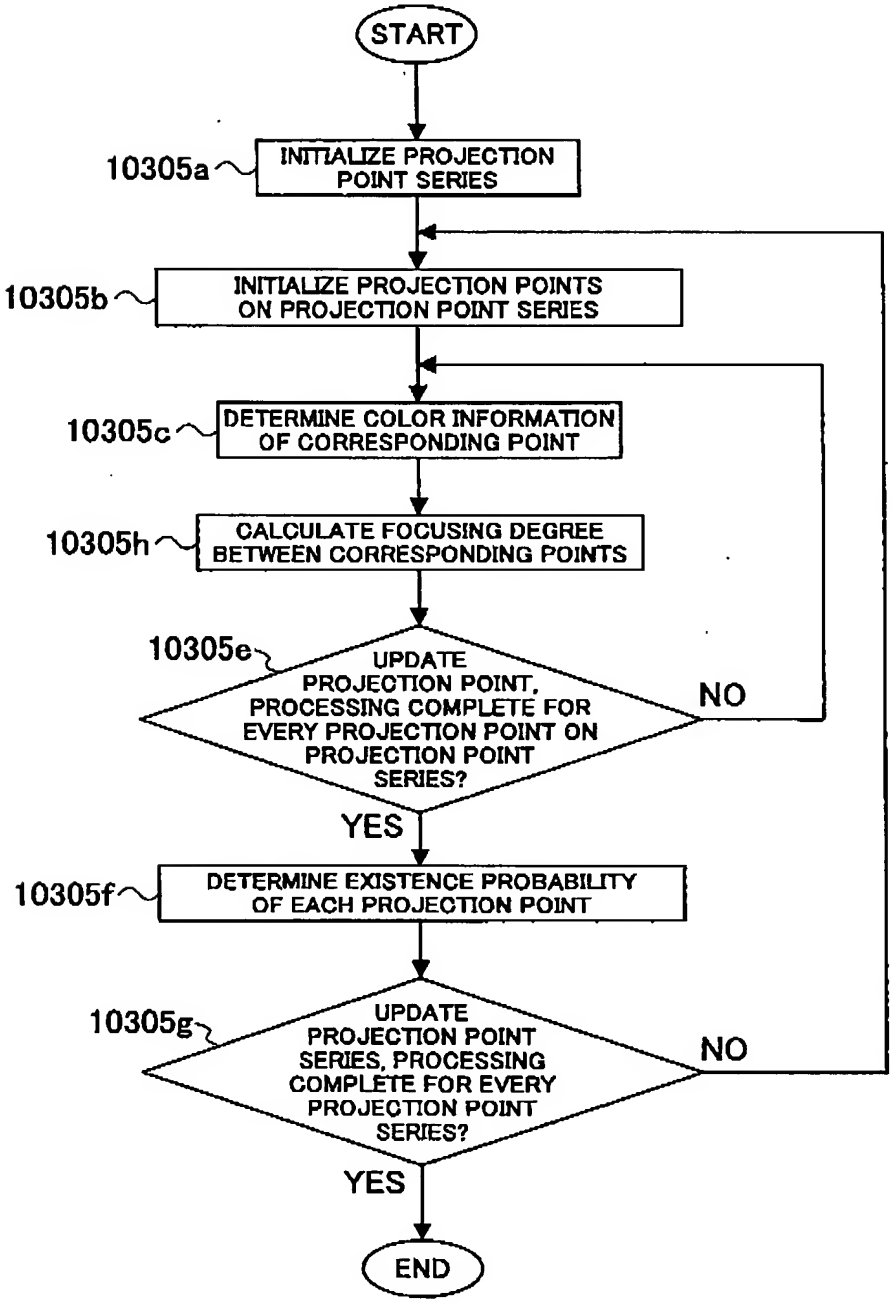
START
10305a
INITIALIZE PROJECTION POINT SERIES
10305b
INITIALIZE PROJECTION POINTS ON PROJECTION POINT SERIES
10305c
DETERMINE COLOR INFORMATION OF CORRESPONDING POINT
10305h
CALCULATE FOCUSING DEGREE BETWEEN CORRESPONDING POINTS
10305e
UPDATE PROJECTION POINT, PROCESSING COMPLETE FOR EVERY PROJECTION POINT ON PROJECTION POINT SERIES?
NO
YES
10305f
DETERMINE EXISTENCE PROBABILITY OF EACH PROJECTION POINT
10305g
UPDATE PROJECTION POINT SERIES, PROCESSING COMPLETE FOR EVERY PROJECTION POINT SERIES?
NO
YES
END

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FIG.103

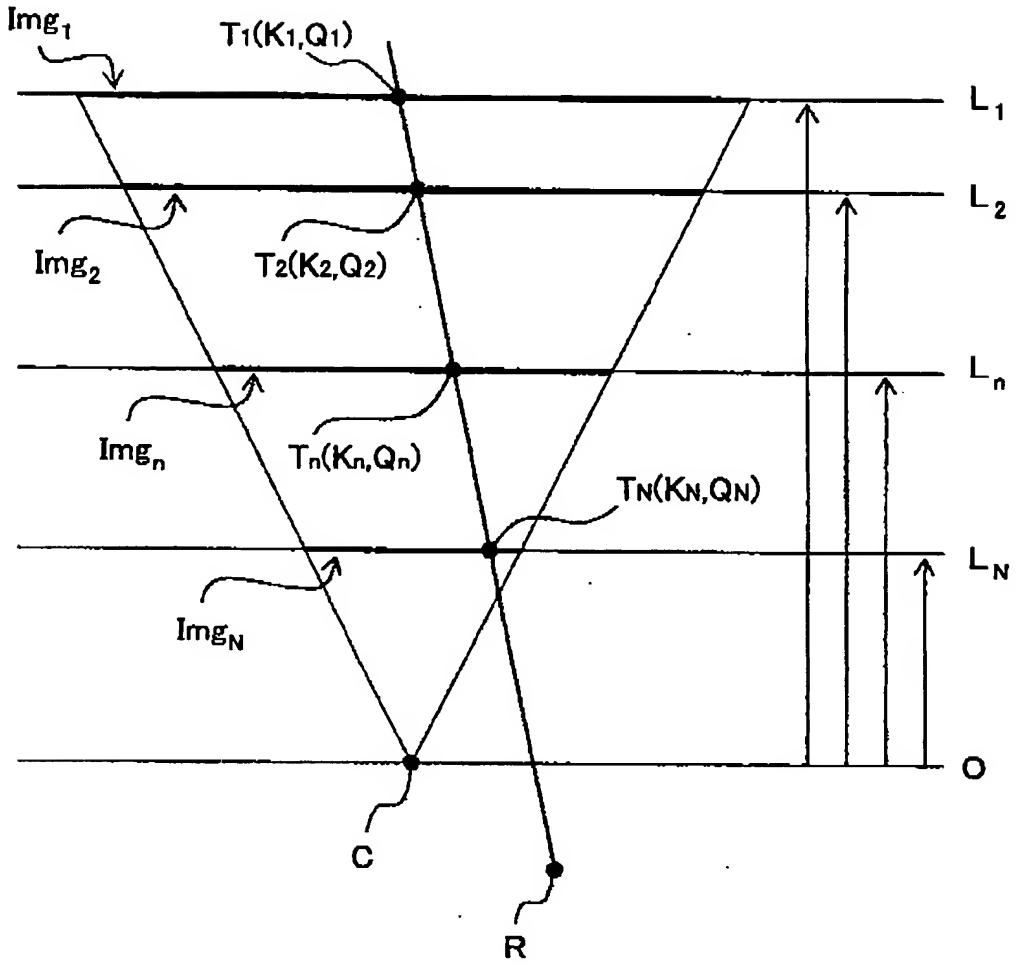
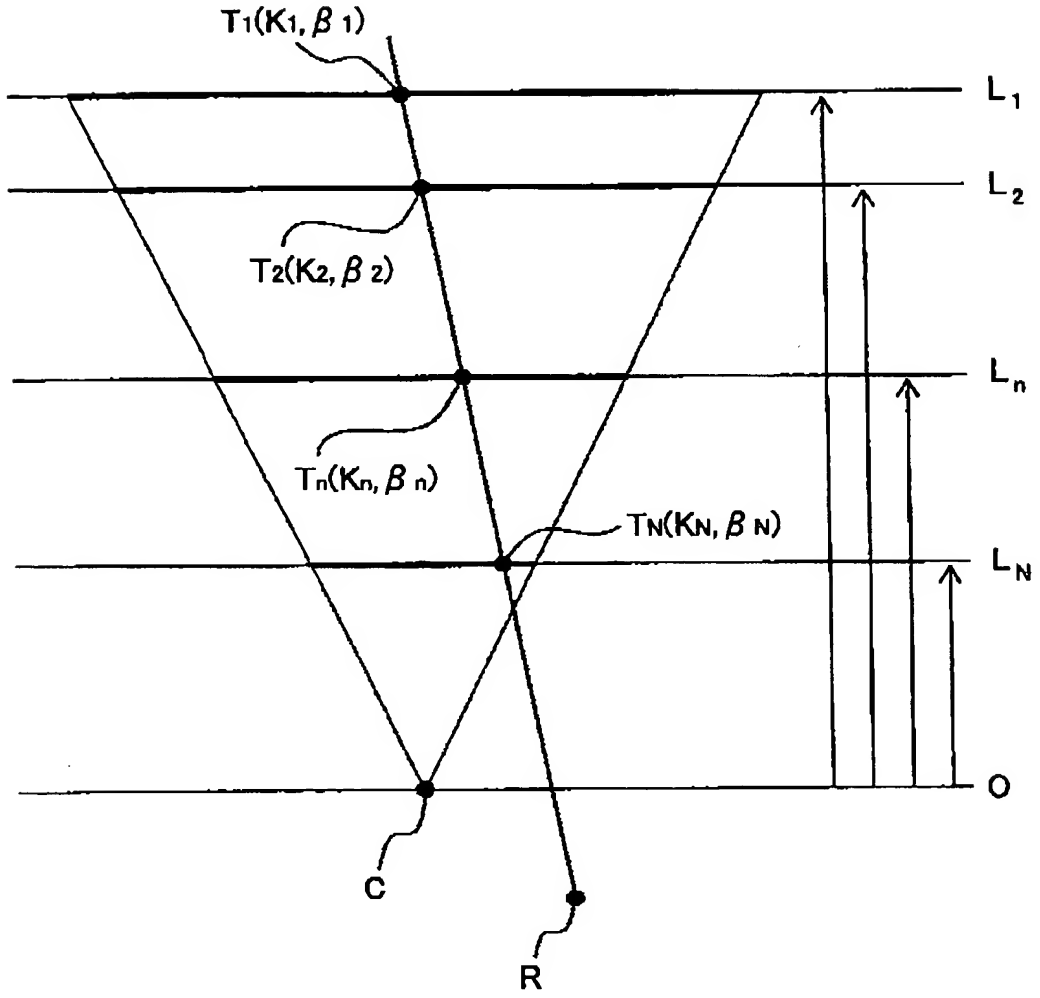
FIG.104